SKYHOOK BALLOON FLIGHTS
FLIN FLON, MANITOBA
CANADA

APPLIED SCIENCE DIVISION
LITTON SYSTEMS INC.

10 December 1964

SKYHOOK BALLOON FLIGHTS
FLIN FLON, MANITOBA
CANADA

Flights 3006 N thru 3013 N and 3015 N and 3016 N
(August 18 through September 18, 1964)
Contract Nonr-4567(00)

Prepared for:

The Office of Naval Research
Washington 25, D. C.

Prepared by:

T. E. O'Malley
R. M. Dungan

Approved by:

K. H. Stefan, Manager
Balloon Engineering
and Operations

Report No. 2650
Project No. 55053

APPLIED SCIENCE DIVISION
Litton Systems, Inc.
2295 Walnut Street
St. Paul 13, Minnesota

TABLE OF CONTENTS

1. IN '64 WE CAME FOR MORE

2. WORK AREA - U. of C. ANTENNA

3. PRELIMINARY WORK CHECK

4. CHUTE CHECKOUT

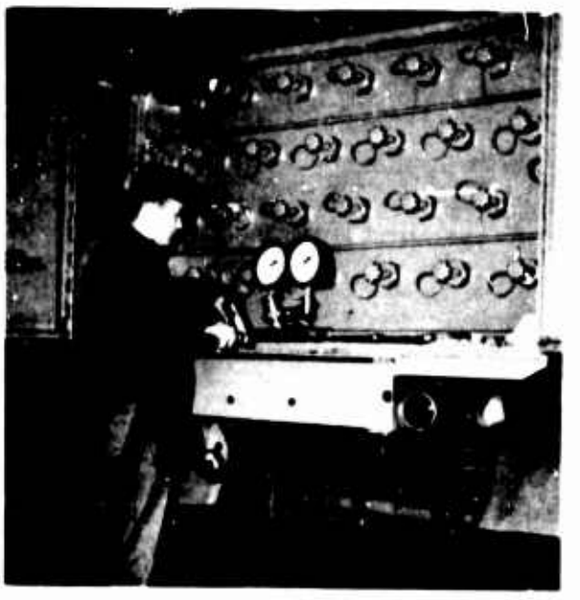
5. U. of C. INSTRUMENT CHECK - 120 K

LOAD BALANCE - 140 K

1. CHUTE ROLL UP

2. ANTENNA CHECK

3. LOAD TRANSPORTATION



4. HELIUM TRUCK

5. LOAD ON RACK

6. BALLOON ROLL OUT

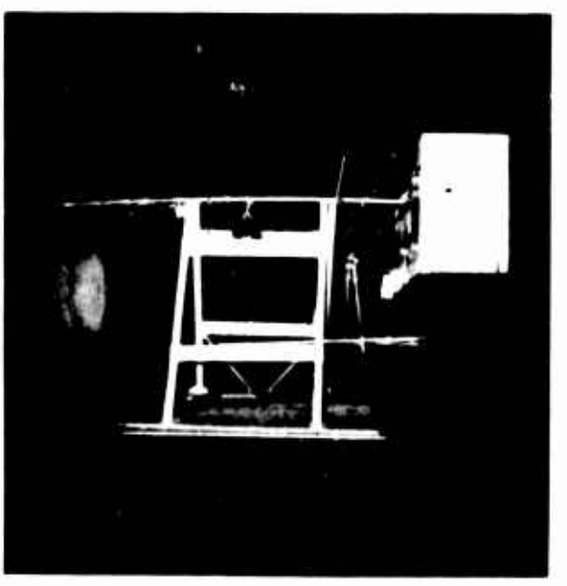
1. FLIGHT LINE CHECK

2. SHOULD HAVE STAYED IN BED!

3. BUBBLE LENGTHENING

4. WIND CHECK

5. PARTIAL INFLATION

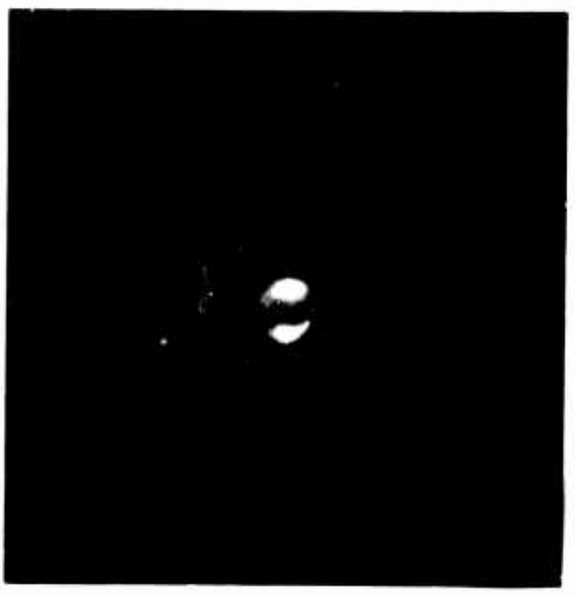


6. LOAD READY FOR FLIGHT

1. READY FOR HAND LAUNCH

2. LAUNCH

3. THEODOLITE TRACKING



4. 130 K

5. U. of C. TELEMETRY

6. LET'S STAY ALIVE IN '65 !

I. INTRODUCTION

This report discusses the planning and execution of a series of balloon flights from Flin Flon, Manitoba, Canada, in August and September of 1964 under contract Nonr-4567(00) for the Office of Naval Research. A total of ten flights carrying gamma ray detectors and associated scientific and balloon control instrumentation was flown for Dr. Kinsey Anderson of the University of California.

The initial Litton Proposal 2151-F dated 6 January 1964 included cost to prepare, launch, track and monitor 14 stratospheric balloon flights from Flin Flon, Manitoba, Canada, for Dr. Kinsey Anderson. Prior to awarding of the contract on 4 March 1964, Litton's Proposal 2151-F was revised to reflect the following schedule:

1) Conduct eight balloon flights, furnish ten balloons (two extra), associated balloon control instruments, and hardware to fly two scientific packages with a combined weight of 60 lb on each of eight flights to an altitude of 3 mb (130,200 ft) to 2.5 mb (134,600 ft) (based on U. S. Standard Atmosphere 1962) for a maximum float time of 10 hours per flight during daylight hours.

2) Provide the following services:

   a) Prepare, check out, calibrate, package, and ship all balloon instrumentation, support equipment and vehicles to Flin Flon.

   b) Establish a base of operations at Flin Flon, Manitoba, Canada.

   c) Maintain close liaison with the ONR Scientific Officer, ONR Resident Offices at Minneapolis, Dr. Kinsey Anderson and associates, and Canadian authorities to insure compatibility of scientific and balloon systems equipment and the performance of correct procedures for balloon flight clearance, launch notification, and tracking information and for the shipment of equipment into Canada.

   d) Maintain a watch for adequate balloon meteorological conditions at Flin Flon; prepare, and launch the balloon systems.

   e) Monitor signals from the barotransmitter altimeter. Track all systems with the aid of radio direction finding equipment, and wherever practical and feasible by optical (theodolite) means.

f) Maintain adequate records of data for inclusion in the project final report.

g) Prepare the project final report including documentation relative to flight information on the performance of the balloon and its associated equipment.

On May 11, 1964, in a conversation between Mrs. Ruby Ward and Mr. H. Demboski of ONR and R. Conlon and R. Gagnon of Litton a revision of our revised proposal 2151-F of 4 March 1964 was made to reflect the latest ONR requirements; instead of ten balloons for 3 to 2.5 mb for packages of 22 and 50 lb, the following was specified: 4 balloons, 172-1-2/0.55 mil poly (1.865×10^6 ft^3) for 2.5 mb and 6 balloons, 111-1-2/0.55 mil poly (510,000 ft^3) for 5.5 mb.

On May 15, 1964, the Office of Naval Research awarded Contract Nonr-4567(00) to Litton Systems, Inc., with funding to conduct six of the planned eight balloon flights. Funds under Contract Amendment No. 1 to cover the cost of the remaining proposed two flights was received on 28 August 1964.

Extension in the field past September 9, 1964 was received via a telephone conversation on September 4, 1964 between Mr. Demboski of ONR and T. O'Malley of Litton Systems Inc. This was later verified in a phone conversation on September 8, 1964, between Mrs. Ruby Ward of the ONR contracting office and Mr. Victor Benson of Litton Systems Inc. contracting office.

Subsequently the Scientific and Contracting Officer of ONR further authorized expenditure of funds to be paid to persons returning recovered equipment from the balloon flights and included plans to launch the additional two balloons in the event that sufficient equipment would be recovered from the first eight flights.

Unlike the Flin Flon Operation of 1963, there were no specific requirements for recovery of balloon flight equipment; therefore, no plans were formulated to employ aircraft in the 1964 operation.

II. FLIGHT PREPARATIONS

The fact that no recovery involving aircraft and personnel was required simplified the initial planning for this year's operation.

Preparations began on May 18, 1964. The following assignments were made and responsibilities delegated.

A. Project Personnel Assignments

Project Engineer	Richard Conlon, Senior Engineer: Overall technical responsibility, coordination of all phases of planning, scheduling, requirements, and systems design.
Field Engineer	Raymond Dungan, Associate Engineer: In charge of overall field equipment specifications, planning, operations. Responsible for field and Canadian border clearances and for conducting the balloon flights.
Flight Technician	Martin Lueders, Senior Technician: In charge of load bar and hardware design, helium requirements, final preparation, packaging and shipment of all equipments, final weight analysis, launch and weather data recording.
Instrument Technician	Eugene Minnich, R&D Technician A: In charge of instrument construction, cabling, system checkout, recording of altitude data and DF positioning information.
Instrument Packaging and Design	M. Koivu, Senior Technician: assisted by E. Minnich, R&D Technician A:
Project Administration	T. O'Malley, Senior Engineer: Administrative responsibility including writing of the final project report.

B. Program Schedule

All plans to be formulated and finalized by June 15, 1964.

All equipment, instruments, and rigging to be packaged and ready for shipment during the week of July 19th for arrival in Flin Flon by August 17th.

Flight plans to be made up and distributed during the week of August 2nd.

Project field engineer to depart for Flin on August 16, spend the 17th in Winnipeg in meetings with Canadian Department of Transport (DOT) authorities and Weather Department personnel.

The flight and instrument technicians to depart Minneapolis on the 17th of August for Winnipeg and a meeting with the field engineer. All three then to depart Winnipeg for Flin Flon on 18 August.

The first scheduled flight day at Flin Flon to be August 21, 1964.

C. Clearances

Important to adequate planning of logistics prior to departure for Flin Flon was the clearance to conduct the operation in Canada and to operate telemetering equipment on desired radio frequencies. In addition, arrangements to ship all equipment and vehicles through Canadian customs had to be made prior to the equipment shipping date, the week of July 19th.

The following were most cooperative and helpful in obtaining the necessary clearances and assisting in shipment of equipment:

Mr. H. Demboski, ONR Code 421 - Scientific Officer
Washington, D. C.

Commander W. Martin - ONR Field Representative
Minneapolis, Minnesota

Mr. G. Bowers - ONR Resident Representative
Minneapolis, Minnesota

1. Operational Clearance

On or about June 25, Litton was informed verbally by Mr. Demboski of the consent of the Canadian Department of External Affairs to conduct the Flin Flon Operation 1964 under conditions set forth in the U. S. Embassy note No. 339, May 15, 1964, and Canadian Note No. 92, June 15, 1964. On July 6, 1964, Litton received a letter from Mr. Demboski dated July 2, 1964, which further confirmed the Canadian Government's clearance. As stated in part in the U. S. Note No. 339, the balloon flights were to be conducted under conditions similar to the flights in 1961, 1962, and 1963. In essence, and to no lesser degree, the flights at Flin Flon in 1964 were to be conducted with all due regard for Canadian life and property. Close liaison was to be maintained with the Regional Air Services Office at Winnipeg and with officials of Trans-Air Limited in Flin Flon. Safety devices were to be used to terminate any balloon which failed to reach 40,000 ft in a predetermined time or subsequently descended below that altitude.

2. Radio Frequency Authorization

In 1963, operations at Flin Flon had experienced interference on the 1750 kcs frequency. In addition, the fact that 1750 kcs is at the top of the frequency band on the ARN-6 radio compass made tuning difficult. Therefore, Litton requested the use of 1710 kcs for the 1964 operation.

Verbal confirmation from the ONR Scientific Office advised Litton that clearance to use 1730 kcs in lieu of 1710 kcs had been received. This confirmation was verified by receipt of a copy of Naval Speed Letter (OP-944D/lg. Ser 42809P94) at Litton on August 13, 1964. The clearance also included approval for 73 mcs with 150F9 emission for telemetry to be used by the University of California group.

3. Shipment Authorization

On July 17, 1964, a letter was sent to the ONR Resident Representative's office with a description of the materials to be shipped to Flin Flon on Government Bills of Lading. Two Government bills were issued by the ONR office. A general description of the material shipped is as follows:

6 boxes balloons @ 208 lb each	1248 lb
each box: 33-1/2 in. x 30 in. x 25-1/2 in.	
4 boxes balloons @ 395 lb each	1580 lb
1 box flight equipment	590 lb
2 26-tube helium trailers	
No. 20634 and No. 91330	56,000 lb
1 Navy panel truck	
No. 94-2195	7000 lb

See Appendix I for a more detailed list of material shipped. All items were shipped into Canada under "Free entry under Tariff Item 708."

D. Miscellaneous Planning

1. Package Integration

Of immediate concern during the preliminary planning was the integration of the University of California's scientific packages with Litton's control instrument packages and flight train. Phone calls and some correspondence between Litton, Dr. Anderson, and David Milton of the University of California clarified physical appearance and weights of their packages. Special emphasis was placed on the location of the University of California's telemetry antennas relative to other components on the flight train. All components of the flight system had to be joined electrically to prevent random electrical noise from interfering with telemetry reception. The space above the top of the University of California's instrument box was to be unobstructed by metal parts.

Overall physical dimensions and description of the University of California packages were as follows:

For the (2.5 mb) 135,000-ft flights:

Height = 21 inches
Width = 16-1/2 inches
Length = 34 inches
Weight = 50 lb
Construction: White styrofoam box
Two flexible VHF antennas each 9 ft in length, operating on 71 and 74 mcs, to be suspended from separate points from the bottom of the box.

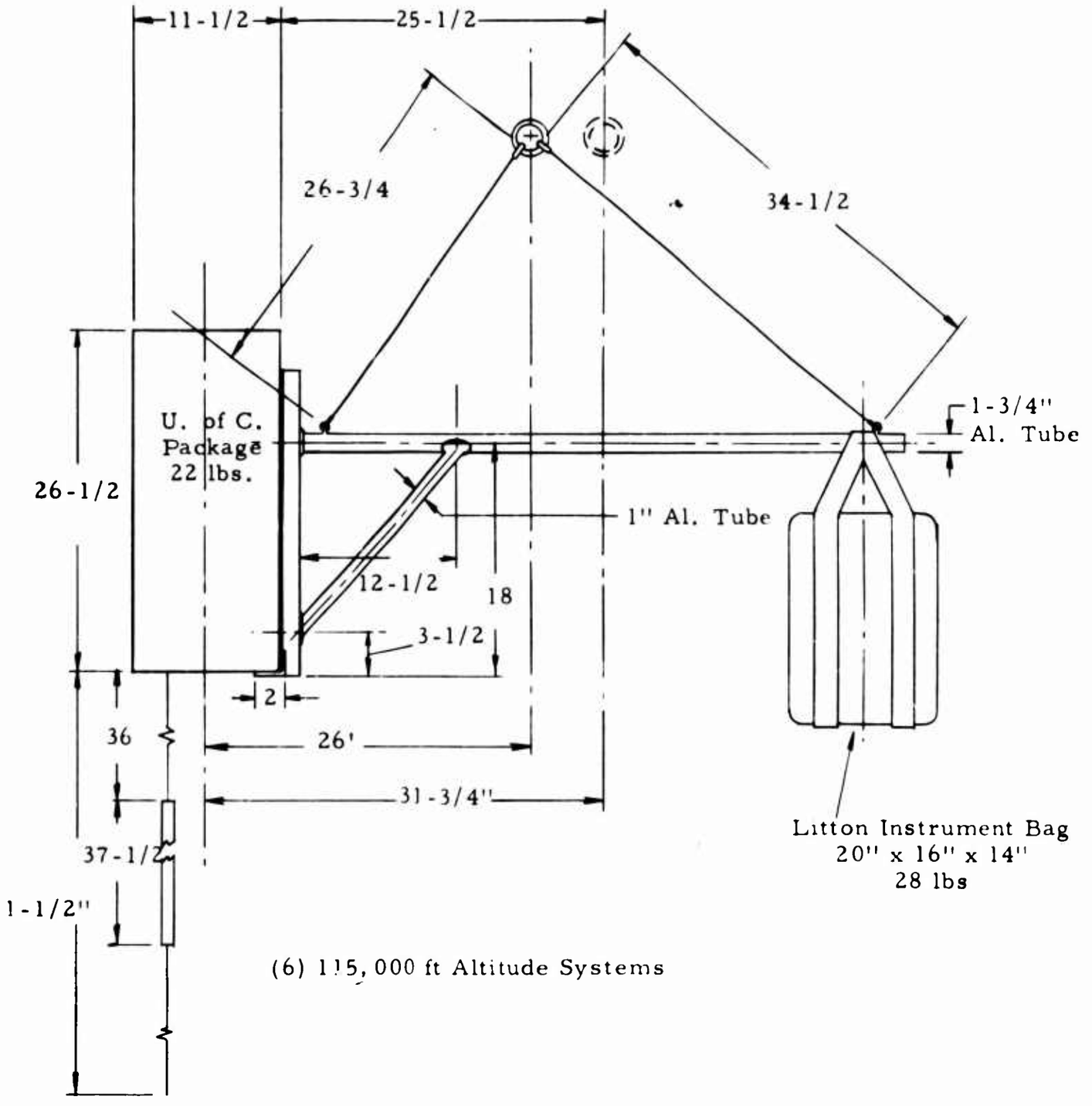
For the (5.5 mb) 115,000-ft flights:

Height = 26-1/2 inches
Width = 11-1/2 inches
Length = 11-1/2 inches
Weight = 22 lb
Construction: White styrofoam box
One VHF flexible antenna with a total length of 9 ft to operate on 73 mcs will be suspended from the bottom of the box

Litton's flight control instrumentation was contained in one instrument bag. Dimensions, weight and description were as follows:

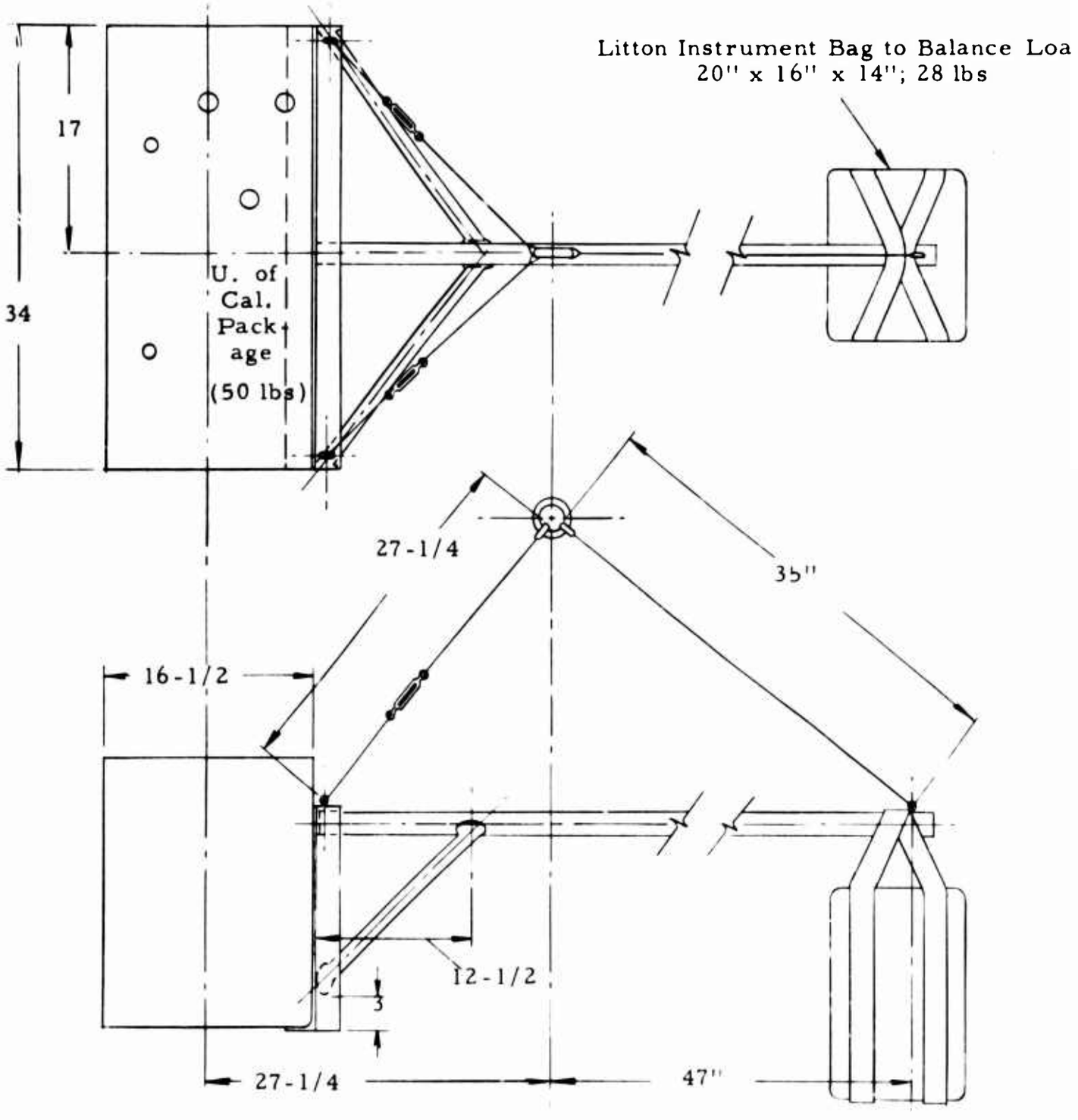
Height = 20 inches
Width = 14 inches
Length = 16 inches
Weight = 28 lb
Instrument Bag Construction: A red canvas outer wall with 1800 lb webbing used as harnessing and the inner wall of a light weight white fabric. Two inches of glass wool between the inner and outer walls furnished protection from the extreme temperatures. Inside dimensions were 16 inches x 12 inches x 10 inches.

The University of California package and the Litton instrumentation bag were suspended beneath the parachute and appropriately placed on the "Load Bars." A different Load Bar design was used for each of the two different payload weights Construction of the load bars was in accordance with Figures 1 and 2. Figures 3 and 4 show how all components were assembled into a flight system.



(6) 115,000 ft Altitude Systems

Figure 1



(4) 135, 000 ft Altitude Systems

Figure 2

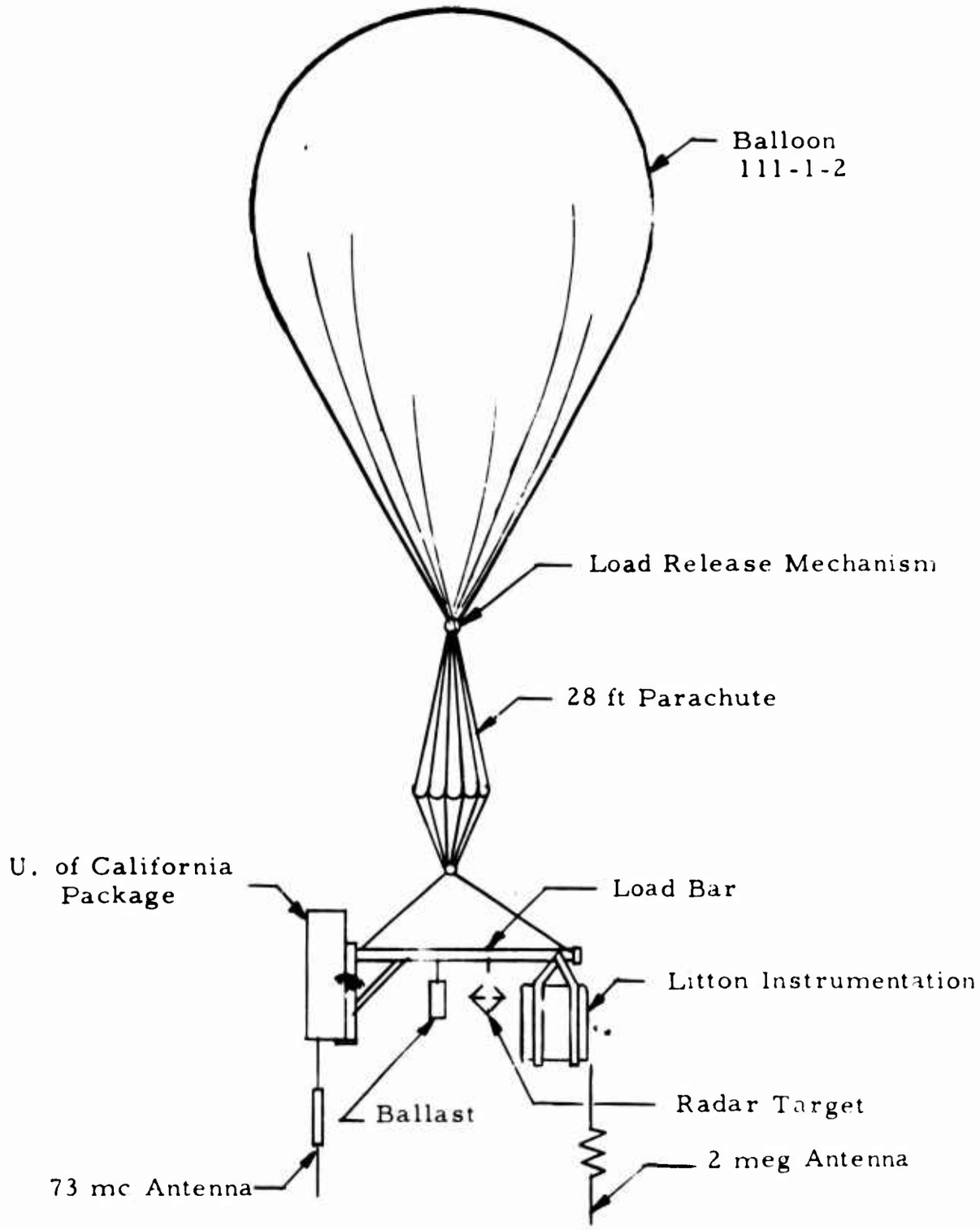

Balloon
111-1-2
Load Release Mechanism
28 ft Parachute
U. of California
Package
Load Bar
Litton Instrumentation
Ballast
Radar Target
2 meg Antenna
73 mc Antenna

Figure 3

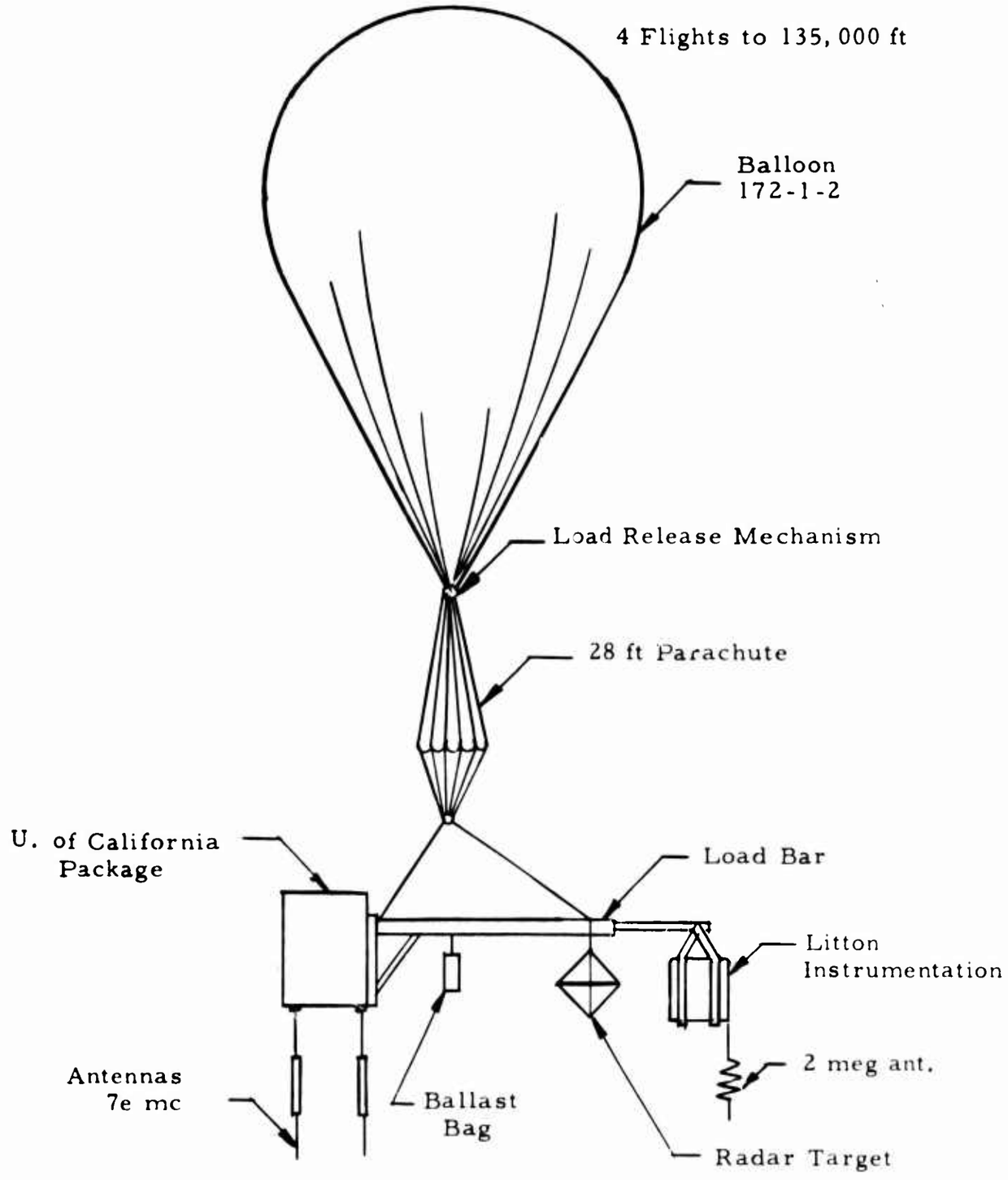

4 Flights to 135, 000 ft
Balloon
172-1-2
Load Release Mechanism
28 ft Parachute
U. of California
Package
Load Bar
Litton
Instrumentation
2 meg ant.
Antennas
7e mc
Ballast
Bag
Radar Target

Figure 4

2. Balloons and Instrumentation

a. Balloons

Balloons were constructed to specifications detailed in Tables 1 and 2 and fabrication commenced on May 21, 1964. All balloon construction (six units of 111-1-2 and four units of 172-1-2) was completed by August 3, 1964. Tailored Tapelens design was standard and a rip panel destruction device was incorporated.

Table 1. Operational Specification Sheet for 111-1-2 Balloon

Fabric Parameter ( )	0.25
Payload (Design	110 Lbs to 116 K
Material (Balloon Wall and Duct)	0.55 Mil Polyethylene
Volume (Theoretical)	517,000 ft^3
Surface Area (estimated)	32,400 ft^2
Inflated Height	92 ft.
Deflated Length (Gore Length)	155 ft.
Load Tapes	None
Fittings; top	3" Dia. Integral
Fittings; bottom	3" Dia. Integral
Number of Ducts	One
Location of Duct	35' from Balloon Base
Inflation Tube	10" Layflat x 2 Mil x 65' lg.
Inflation Attachment	10' from Top Apex
Destruction Device	Inverted "V"
Descent Valves	None
Estimated Balloon Weight	110 lbs
Engineering Specification Sheet	234120
DRS	715
Load Altitude Curve	234121

Table 2. Operational Specification Sheet for 172-1-2 Balloon

Fabric Parameter ( )	0.35
Payload (Design)	110 lbs to 135 K
Material (Balloon Wall and Duct)	0.55 Mil Polyethylene
Volume (theoretical)	1,869,400 ft^3
Surface Area (estimated)	75,510 ft^2
Inflated Height	133.2 ft
Deflated Length (Gore Length)	234 ft
Load Tapes	None
Fittings; top	3" Dia. Integral
Fittings; bottom	3" Dia. Integral
Number of Ducts	One
Location of Duct	45' from Balloon Base
Inflation Tube	10" Layflat x 2 Mil x 65' Lg.
Inflation Attachment	15' from Top Apex
Destruction Device	Inverted "V"
Descent Valves	None
Estimated Balloon Weight	240 lbs
Engineering Specification Sheet	234123
DRS	716
Load Altitude Curve	234124

b. Instrumentation

Balloon instrumentation was completed and ready for shipment by the week of July 19, 1964. Because there was no requirement for recovery instrumentation was kept to a minimum. Part of the Safety Switches and Barotransmitter were furnished GFE and part were new.

Safety Switch (used for flight termination). - Five new S-15 safety switches with Litton serial No. 008-012 were constructed and three GFE units with serial No. 003, 005, and 007 were repaired for use. All eight units were modified from the original S15 configuration to include ballast dropping circuits.

Litton's model S-15 safety switch was provided to meet the requirements of OPNAVINST 3710.18A. It complies with the regulation governing rate of ascent and descent below 44,000 ft and furnishes the means for final flight termination within a period of 24 hours. The unit features mechanical timers and simple design for good reliability on shorter duration flights. With the ballast drop modification, if during the first 40 minutes of flight the system does not advance past the 20,000 ft altitude, one ballast drop would be made by timer control. If the system ascended past the 20,000 ft altitude in less than 40 minutes, the ballast drop would be made at 70,000 ft by pressure switch circuitry.

Redundant Safety Switch. - In addition to the S-15 safety switch, for redundancy a combination of one twenty-four hour mechanical timer and switch with its individual 7-1/2 volt battery was employed to backup the S-15 for final flight termination.

Barotransmitter (used for telemetering altitude data and furnishing a RDF signal). - Six new Litton B-35 barotransmitters with Litton Serial No. 001-006 were constructed and two GFE combinations of Litton B-25 barocoders with serial No. 017 and 027 were separately matched and integrated with one each of two GFE Litton T-12 transmitters with serial No. V and 038. Regardless of the combinations, a description of the B-35 performance fits the B-25 and T-12 combination.

Litton's model B-35 barotransmitter includes a solid-state 5-watt beacon transmitter keyed by a barocoder which translates pressure altitude information into code groups. Preflight calibration in terms of code groups versus altitude provides the necessary data for retranslating the code groups received during the flight back into useful altitude information. The unit is effective to 140,000 ft and has the following reliability

0 to 100,000 ft ± (500 to 1000 ft per code change)
100,000 to 130,000 ft ± (1000 to 2000 ft per code change)
130,000 to 140,000 ft ± (2000 to 4000 ft per code change)

Power Supplies - The main instrument package, the barotransmitter, and the S-15 safety switch were powered by four Everready #520 Alkaline batteries in series. Total nominal voltage was 24 volts dc and available power was 12.8 ampere hours. The main instrument package required a total maximum of 9.6 ampere hourse from the main power supply for a period of 24 hours. One Eveready #560 Alkaline battery with a nominal voltage of 7-1/2 volts dc used as a one shot power supply to energize two grain DuPont S-68 squibs for flight termination was employed with the redundant safety switch.

3. Miscellaneous Items of Planning

Flight Plan. - Flight plans were complete and published on August 5, 1964. Launch schedules, anticipated time altitude curves, anticipated system weights and instrumentation and flight line check list were included in the plan. Anticipated weights of the two systems were as follows

	Weight of Each System	
Equipment	2.5 mb	5.5 mb
Balloon	240 00	110 00
Parachute	13 00	13 00
Instruments and Bag (Litton)	26 00	26 00
University of California Instrument Bag	50 00	22 00
Ballast	10 00	7 00
Hardware (Load Bar, etc.)	10.00	5 00
Radar Target	1 00	1 00
Total (anticipated) Gross	350 00 lb	184 00 lb

Radar Targets and Ballast Bags. - We planned to construct the radar targets at Flin Flon of cardboard boxes 12 inches x 12 inches x 12 inches covered on all sides by aluminum foil. The ballast bags were to be rigged from pieces of the main balloon's inflation tubing.

Equipment Packaging and Shipment. - By July 31, all equipment and instrumentation had been completed and prepared for shipment.

The two helium trailers left Minneapolis on GBL A6164927 on July 29 via Great Northern Railway to Winnipeg and by Canadian National Railroad to Flin Flon.

The ten boxes of balloons, one box of flight equipment, and the panel truck left Minneapolis on GBL A6164928 on August 3 via the Great Northern Railway to Winnipeg and by Canadian National Railroad to Flin Flon.

Personnel Final Plans. - On August 14, all preparations were complete and field personnel made final plans to depart for Flin Flon. Reservations were made at the Paradise Lodge at Flin Flon.

Mr. Ray Dungan - Field Engineer - departed on Sunday, August 16, 1964.

Messrs Lueders and Minnich - Field Technicians - departed on Monday, August 17, 1964.

On August 17, all flight preparations were completed.

III. FIELD OPERATIONS

A. Arrangements with the Canadian Government

On August 17, the Litton Field Engineer visited with the Canadian Government Offices at Winnipeg to make the necessary arrangements for the filing of Flight NOTAMS and to obtain weather information prior to each balloon launching.

Mr. Brereton, ATC District Supervisor (Telephone 942-8571) and Mr. Skinner, Chief of ATC at the Winnipeg National Airport (Telephone 783-7623) and Mr. Pincock of Canadian flight Weather Service were most cooperative and helpful. We were instructed to call preliminary NOTAMS to Mr. R. E. Noden at the Pas 6 hours prior to the balloon launching. All other NOTAMS including a 2-hour confirmation and/or any cancellation or hold NOTAMS up to launch time were to be filed with Mr. Noden at the Pas. It was agreed that no launch NOTAM would be required. Flights could be launched during the A. M. twilight and into a high thin overcast early in the morning.

We were advised that Mr. Pincock would furnish us with high altitude wind data. This information and other weather data would be ready for us at 0400 local time each day at the public forecaster's office (Telephone 786-4125). Surface charts and 500 mb charts would be sent to us daily except Sunday via Trans Air Airline.

All balloon launchings at the airport at Flin Flon were to be coordinated with the scheduled Trans Air Flights into and out of Flin Flon. Mr. Tom Kastiuk, Manager of the Flin Flon Municipal Airport was made aware of this procedure.

B. Field Preparations

On August 18, Litton's Field Engineer, Ray Dungan, and field technicians Gene Minnich and Marty Lueders arrived at Flin Flon. The two helium trailers (USN 20634 and USN 91330), the Navy panel truck (USN 94-21965), all balloons, flight and support equipment were in the area. All items appeared to be in good shape except that the draw bar on the balloon launch platform was broken. Steps were taken to have it repaired immediately.

Preparations began immediately to establish the base of operations. At Baker's Narrows, Litton's telemetry equipments were set-up in the operational trailer with the University of California equipment. Antennas were put up and all equipment checked to our satisfaction. The theodolite was installed and leveled-up. Its proper geographical positioning was checked later with the North Star.

The University of California's crew, which had arrived a few days earlier than Litton personnel, advised that August 21 looked like the first possible launch day from their point of view, and that a low altitude flight was the first desirable flight.

On August 19, two sets of balloons and equipment were made ready for two low altitude flights. Mr. Dave Milton advised Ray Dungan that his group would have two sets of their equipment on the flight line. Either one could replace the other in the event of an instrument problem.

The launch technique was explained to Mr. Milton, and he and Mr. Dungan discussed launch problems and possible assistance from the University of California group.

Arrangements were made with the Manitoba telephone company for the use of a telephone and a $100.00 deposit was made to open a telephone charge account for Litton Systems, Inc.

Cmdr. Martin of ONF, Dr. Anderson of the University of California, arrived this a.m. and Karl Stefan, Manager of Balloon Operations and Engineering at Litton arrived on August 20. Final preparations were made

for the first flight on August 21. The launch platform was repaired and was in excellent condition.

Litton's crew constructed a cart from four large wheel casters using a 4 feet x 4 feet x 3/4 inch-thick plywood as a base. A frame to hold the main instruments and load bar prior to and during the launching was also constructed. The cart served as a vehicle in laying out the balloon and as a launching aid for the main package during the launch.

Eight radar targets constructed of 12 inch x 12 inch x 12 inch cardboard boxes and covered on all sides with aluminum foil were made.

All field preparations were completed for the first flight by August 20.

C. Flight Operations

A listing of pertinent data and a discussion on a day by day basis between each flight is presented in chronological order by days and flight numbers. Flight profiles for each flight are attached in Appendix II.

1. Company Litton Systems, Inc. Flight number 3006N

2. Scientist Dr. Kinsey Anderson Organization University of California

3. Launch: Site Flin Flon Municipal Airport, Manitoba, Canada Date/time 23 August 1964; 0643 CDT
launch
Technique platform-hand Director Ray Dungan

4. Weather: broken clouds; +13°C; NW 4 to 6 mph - high Tropopause: Height 35,000 est Temp -50 est.
(sky-temp-wind-press)

5. Balloon Ceiling: Theoretical 4.4 Mbs 121,000 ft. Actual: 109,800 ft. 7.26 Mbs
How altitude determined B-35 Baro-transmitter altitude sensing device

6. Ascent: Surface to tropopause 501 fpm Tropopause to ceiling 214 fpm.

7. Flight duration: Total 14 hrs. 47 min. At ceiling 8 hrs. 8 min.

8. Termination: Time 0114 Z Altitude 100,600 ft. Cause mechanical timer
unknown--balloon over thunderstorm--

9. Balloon destruction - confirmed balloon equipped with rip panel destruction device
(visual - unknown - etc.)

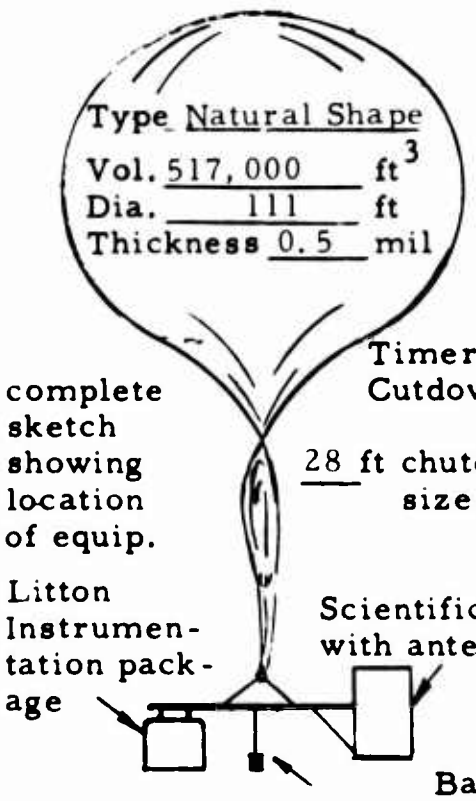
10. Impact: Date/time 24 August 1964 0230 Z Location unknown--ADF bearing 15° from launch site

11. Frequency used:

(kcs, Mcs)	(purpose)	(Total Time)
1730 kcs	determine altitude	14 hrs 47 min
	and	
	ADF bearings	

12. Balloon: Code number 111-1-2 Serial number DRS 715 balloon No. 2

Type Natural Shape
Vol. 517,000 ft^3
Dia. 111 ft
Thickness 0.5 mil



complete sketch showing location of equip.

Balloon	109.00
FAA Termination Timer	
Parachute	15.75
Instrumentation (Litton)	27.50
Ballast	5.25 2.8%GW
Scientific package	21.25
Other (Gondola & radar target)	6.50
Gross Weight	185.25
Free Lift	13.00
Gross Inflation	198.25
Helium used	3,003 ft^3

Remarks:
FAA termination timer included in Litton instrumentation weight

Launching of flight 3006 was cancelled on August 21 due to overcast and strong surface winds; on August 22 it was cancelled due to rain and a solid overcast.

On August 23, at 0110, the launching crew arrived at the launch site. There was a solid overcast and shortly thereafter it started to rain.

The weather forecaster at Winnipeg advised that the clouds and rain were local and should move out in about one hour. We proceeded with flight plans and at 0643 the flight was launched successfully. At launch time, scattered clouds were in the area, the rain had stopped, and the surface winds were about 6 mph. Thunderstorms remained in the area during most of the flight and RDF bearings were difficult to get. However, we were able to get some theodolite bearings in the afternoon.

The rate of ascent for the flight was very slow due to an inadequate amount of free lift.

On August 27, the flight packages for 3006N were found 125 miles north and east of Flin Flon by Mr. Sickman of the Manitoba Government Air Service (Telephone MA 3-3841 from Grace Lake through the Pas). They were returned to Flin Flon for use on another flight.

1. Company Litton Systems, Inc. Flight number 3007 N

2. Scientist Dr. Kinsey Anderson Organization University of California

3. Launch: Site Flin Flon Municipal Airport Manitoba, Canada Date/time 25 Aug 1964; 0429 CDT
Technique platform-hand launch Director Ray Dungan

4. Weather: clouds broken; +9°C; NNW 4 to 6 mph; high (sky-temp-wind-press) Tropopause: Height 30,000 Temp -40°C

5. Balloon Ceiling: Theoretical 2.51 Mbs 134,500 ft. Actual: 131,500 ft. 2.84 Mbs
How altitude determined B-35 baro-transmitter altitude sensing device

6. Ascent: Surface to tropopause 784 fpm. Tropopause to ceiling 508 fpm.

7. Flight duration: Total 16 hrs. 12 min. At ceiling 11 hrs. 20 min.

8. Termination: Time 0041 Z Altitude 121,200 ft. Cause mechanical timer

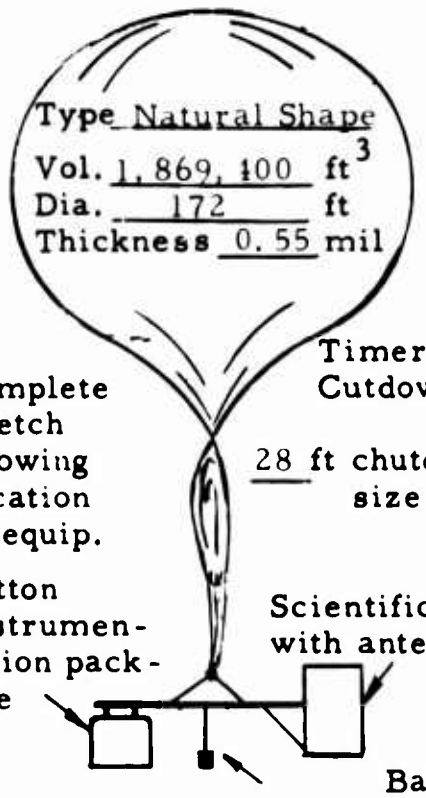
9. Balloon destruction - confirmed balloon destroyed--visual through theodolite
(visual - unknown - etc.)

10. Impact: Date/time 26 August 1964 0140 Z Location unknown--approximately 54° 30'N 104° W

11. Frequency used:

(kcs, Mcs)	(purpose)	(Total Time)
1730 kcs	determine altitude and ADF bearings	16 hrs 12 min

12. Balloon: Code number 172-1-2 Serial number DRS 716, Balloon No. 4



complete sketch showing location of equip.

Balloon	234.00
FAA Termination Timer	
Parachute	15.50
Instrumentation (Litton)	27.75
Ballast	10.50 2.9% GW
Scientific package	58.50
Other (Gondola & radar target)	15.75
Gross Weight	362.00
Free Lift	34.50
Gross Inflation	396.50
Helium used	6.007 ft3

Remarks:

FAA termination timer is included in Litton instrumentation weight

On August 24, flight 3007N was cancelled due to solid overcast, rain and strong winds.

On August 25, the launching crew arrived at the launching site at 0100 local time.

Launching of flight 3007N at 0429 was very smooth. The sky was clear and there were no surface winds. About 30 minutes after the launching the area became clouded over. At this time no theodolite tracking was possible. Later in the morning and throughout the flight to termination theodolite bearings were obtained. At the time of release a solid bank of clouds was apparent in the west. No RDF bearings were taken on this flight.

Flight 3007N was not recovered, but from the data obtained it is definitely known that the flight terminated.

1. Company Litton Systems, Inc. Flight number 3008 N

2. Scientist Dr. Kinsey Anderson Organization University of California

3. Launch: Site Flin Flon Municipal Airport, Manitoba, Canada Date/time 26 August 1954, 0500 CDT

Technique platform-hand launch Director Ray Dungan

4. Weather: low solid overcast; +13° C (sky-temp-wind-press) Tropopause: Height 40,000 Temp -58°C

5. Balloon Ceiling: Theoretical 121,000 Mbs 4.4 ft. Actual: 15,700 ft. 556.14 Mbs

How altitude determined B-35 Baro-transmitter altitude sensing device

6. Ascent: Surface to tropopause -- fpm. Tropopause to ceiling -- fpm.

7. Flight duration: Total 1 hrs. 40 min. At ceiling -- hrs. -- min.

8. Termination: Time 1140 Z Altitude ground ft. Cause balloon failure

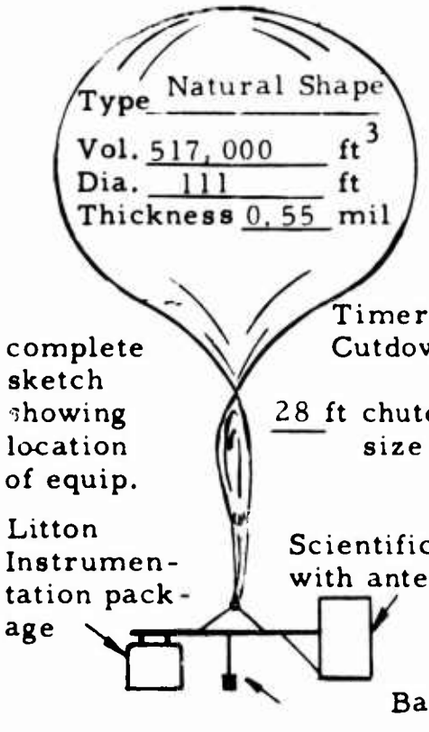
9. Balloon destruction - confirmed visual--saw balloon on the ground (visual - unknown - etc.)

10. Impact: Date/time 26 August 1964 1140 Z Location 35 miles north of Flin Flon, Manitoba, Canada

11. Frequency used:

(kcs, Mcs)	(purpose)	(Total Time)
1730 kcs	determine altitude and ADF bearings	1 hr. 40 min.

12. Balloon: Code number 111-1-2 Serial number DRs 715 Balloon No. 3



Balloon	109 00
FAA Termination Timer	
Parachute	15.25
Instrumentation (Litton)	27.75
Ballast	5.25 2.8%GW
Scientific package	21.00
Other (Gondola & radar target)	6.75
Gross Weight	185.00
Free Lift	18.50
Gross Inflation	203 50
Helium used	3 083 ft³

Remarks:

FAA termination timer is included in Litton instrumentation weight. Balloon was launched in wind 6 to 8 mph with gusts up to 12 mph. Sky condition was low solid overcast. Balloon ascended to 15,700 ft and then descended to the ground

On August 26, the launching crew proceeded to the launching site at 0100 local time. At that time local weather conditions did not appear serious but they gradually deteriorated.

Apparently the University of California's magnetometer indicated ideal conditions had developed for their scientific objective, and Ray Dungan was told by the scientist in charge to launch regardless of surface conditions.

During the balloon layout, surface winds calmed down, but by the time inflation started the winds were gusting to 12 knots.

Flight 3008N was successfully launched at 0500 with the balloon at launch noticeably being buffetted by gusts of wind. The flight ascended to 14,650 ft and immediately began to descend. At this time Cmdr. W. Martin of ONR and Minnich and Lueders of Litton went to Parsons Airways, rented a Cessna 180 and located the balloon and its payload about 30 miles north of Flin Flon. They could not effect a recovery. Parsons Airways was hired to recover the package on August 27.

The exact reason for the balloon's descent is not known. However, it is thought that the rough treatment it received at the time of launch may have contributed to its failing to ascend higher than 14,650 ft.

1. Company Litton Systems, Inc. Flight number 3009 N

2. Scientist Dr. Kinsey Anderson Organization University of California

3. Launch: Site Flin Flon Municipal Airport, Manitoba, Canada Date/time Balloon broke in platform
   Technique platform - hand launch Director Ray Dungan

4. Weather: cloudy; +14°C; North 6-8 mph; low (sky-temp-wind-press) Tropopause: Height 40,000 est Temp -52°C

5. Balloon Ceiling: Theoretical 2.5 Mbs 134,500 ft. Actual: -- ft. -- Mbs
   How altitude determined ------

6. Ascent: Surface to tropopause -- fpm. Tropopause to ceiling -- fpm.

7. Flight duration: Total -- hrs. -- min. At ceiling -- hrs. -- min.

8. Termination: Time -- Z Altitude -- ft. Cause ------

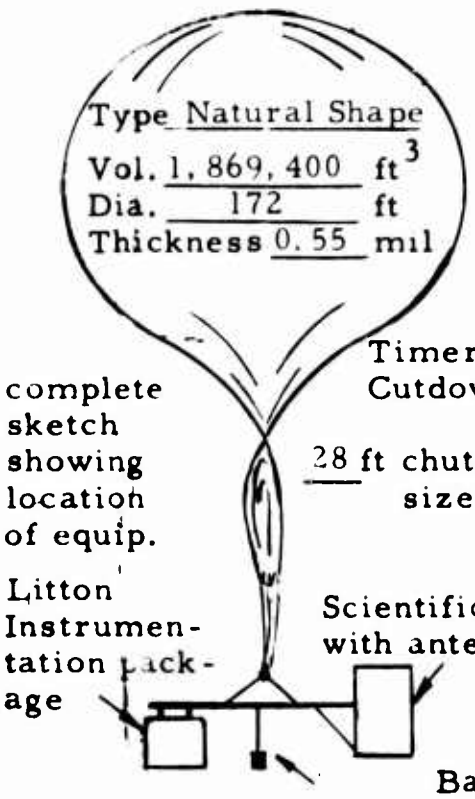
9. Balloon destruction - confirmed ------- (visual - unknown - etc.)

10. Impact: Date/time ---- Z Location -----

11. Frequency used:

(kcs, Mcs)	(purpose)	(Total Time)
----	----	----

12. Balloon: Code number 172-1-2 Serial number DRS 716. Balloon No. 1



Balloon	231.00
FAA Termination Timer	
Parachute	15.75
Instrumentation (Litton)	27.50
Ballast	13.50, 3.8%GW
Scientific package	54.50
Other (Gondola & radar target)	16.75
Gross Weight	359.00
Free Lift	43.00
Gross Inflation	402.00
Helium used	6,090 ft3

Remarks:

FAA termination timer included in Litton instrumentation weight. Balloon broke in the launch platform due to a 12 to 15 knot gust of wind.

On August 27, weather conditions for flight 3009N were the same as for flight 3008N; ground monitoring of magnetic activity indicated excellent conditions for scientific purposes, and thus the scientific opportunity justified, in the opinion of the scientist, an attempt to launch the balloon system under the adverse meteorological conditions which prevailed.

The crew arrived at the launch site at 0130 local time and proceeded to lay out the balloon at 0230. At 0400 balloon inflation began. With about three minutes left to inflate, a sudden gust of wind—estimated to be 12 to 15 knots—caused a seal of the balloon to split. (This seal was located between the inflation tube and rip panel.) Immediately the balloon expelled all gas and settled down over the launch platform.

At this time, it can only be concluded that the balloon was destroyed on the platform due to exposure to wind conditions at the launching site.

1. Company Litton Systems, Inc. Flight number 3010 N

2. Scientist Dr. Kinsey Anderson Organization University of California

3. Launch: Site Flin Flon Municipal Airport Manitoba, Canada Date/time 29 August 1964 0444 CDT

Technique platform-hand launch Director Ray Dungan

4. Weather: clear; +12°C; calm; high (sky-temp-wind-press) Tropopause: Height 40,000 Temp -50°C

5. Balloon Ceiling: Theoretical 4.5 Mbs 120,500 ft. Actual: 116,000 ft. 5.4 Mbs
How altitude determined B-25 Barocoder altitude sensing device

6. Ascent: Surface to tropopause 867 fpm. Tropopause to ceiling 877 fpm.

7. Flight duration: Total 16 hrs. 40 min. At ceiling 13 hrs. 6 min.

8. Termination: Time 0102 Z Altitude 90,800 ft. Cause mechanical timer

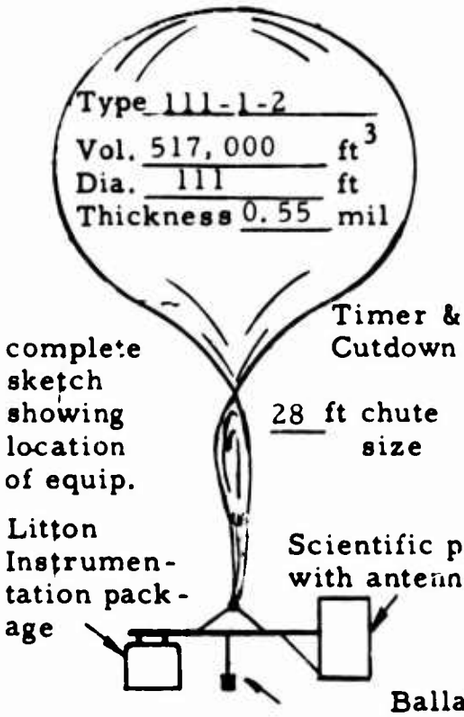
9. Balloon destruction - confirmed unknown; overcast skies; balloon equipped with rip panel
(visual - unknown - etc.)

10. Impact: Date/time 30 August 1964 0224 Z Location A bearing of 225° from launch site; approx. 20 to 30 miles

11. Frequency used:

(kcs, Mcs)	(purpose)	(Total Time)
1730 kcs	determined altitude and take bearings	16 hrs. 40 min.

12. Balloon: Code number 111-1-2 Serial number DRS 715, Balloon No. 5



complete sketch showing location of equip.

Balloon	111.00
FAA Termination Timer	
Parachute	16.00
Instrumentation (Litton)	29.75
Ballast	5.25 2.7% GW
Scientific package	21.00
Other (Gondola & radar target)	6.7
Gross Weight	189.75
Free Lift	26.56
Gross Inflation	216.31
Helium used	3,272 ft³

Remarks:

FAA termination timer included in Litton instrumentation weight.

On August 28, the crew arrived at the launch area at 0100 local time for a 0400 launch. Sky conditions were excellent, but the surface winds at the launch site were 8 to 10 knots. The weather forecaster at Winnipeg said that wind conditions were not expected to improve. The crew waited at the launch site until 0400 when the launch was cancelled due to the surface conditions.

On August 29, the weather appeared to be favorable. When the crew arrived at the launch area at 0130 local time, surface conditions were very calm and skies were clear.

Flight 3010N was successfully launched at 0444. Rate of rise to 116,000 ft averaged 872 fpm. Six hours after launch, a series of thunderstroms developed under the balloon system, and it immediately began a slow descent to 90,800 ft. At this time the flight was terminated by timer. Altitude data received indicated definite termination. The flight equipment was not recovered.

Good theodolite data was collected until 27 minutes prior to flight termination. A few RDF bearings were taken.

On August 30, Mr. David Milton left Flin Flon for California leaving Mr. George K. Parks in charge of the scientific group. At 0100 hours on August 31, Ray Dungan and George Parks checked the magnetometers at the field. No magnetic activity was indicated, therefore, George Parks cancelled the flight. Later in the day the weather became worse; there were some spotty rain showers and several decks of clouds appeared. All hands were on notice for a possible flight on September 1, and clearance was filed for a 0430 launch.

On September 1, Dungan and Parks arrived at the field at 0115 local time. There was some rain and drizzle at the time, and an ideal magnetic storm was in the making. The rains continued until 0530 when the flight was cancelled. If a launching could have been made as late as 0800, George Parks was willing to settle for less time at ceiling and a shorter flight. However, the weather would not permit it. The flight was cancelled due to overcast, rain and winds. The weather was not expected to improve for a launching on September 2; however, a launch NOTAM was filed.

On September 2, the crew arrived at the launch area at 0115 local time. There were high winds, 15 to 20 knots, and a solid overcast. Conditions became worse, and at 0530 the flight was cancelled.

It appeared that there would be only two or three days more of magnetic storm activity and that the weather was not going to improve. To be on the safe side, however, a launch NOTAM was filed for 0430 on September 3.

On September 3, at 0130, Ray Dungan and George Parks went out to the field in a rain storm and cancelled the flight at 0419.

Parks received information from Dr. Anderson that clearance to fly the remaining flights during nighttime had been received from the Canadian Government. Ray Dungan immediately initiated liaison with the Navy to obtain authority for night flights. The University of California agreed to furnish the necessary lights and power for the night flights.

A NOTAM was filed for a flight in the morning on September 4.

1. Company Litton Systems, Inc. Flight number 3011 N

2. Scientist Dr. Kinsey Anderson Organization University of California

3. Launch: Site Flin Flon Municipal Airport Date/time 5 September 1964 0415 CDT
Technique platform-hand launch Director Ray Dungan

4. Weather: clear; +11°C; southwest 4-6 knots; low Tropopause: Height 40,000 Temp -51°C
(sky-temp-wind-press)

5. Balloon Ceiling: Theoretical 2.5 Mbs 134,250 ft. Actual: -- ft. -- Mbs
How altitude determined B-35 Baro-transmitter sensing device
33,300 33,300 max. alt.

6. Ascent: Surface to ~~tropopause~~ 415 fpm. Tropopause to ceiling 60 fpm.

7. Flight duration: Total 4 hrs. 4 min. At ceiling -- hrs. -- min.

8. Termination: Time 1319 Z Altitude Balloon descent to ground ft. Cause balloon failure balloon on ground

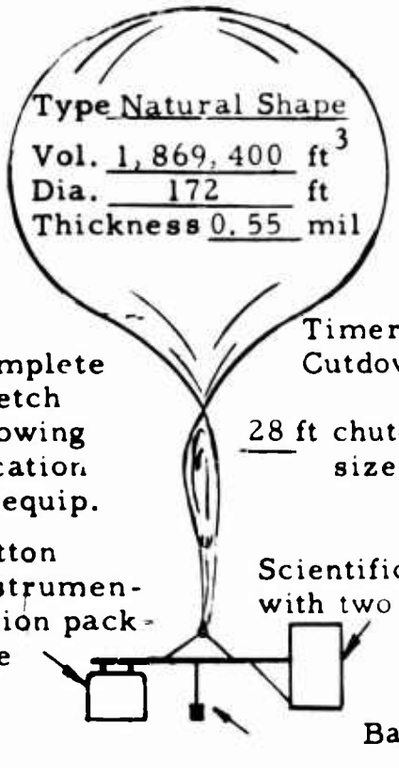
9. Balloon destruction - confirmed unknown - cloud cover - balloon equipped with (visual - unknown - etc.) rip panel de-

10. Impact: Date/time 5 September 1964 1319 Z Location unknown--ADF bearing 075° from launch site struction device

11. Frequency used:

(kcs, Mcs)	(purpose)	(Total Time)
1730 kcs	to determine alti-	4 hr 4 min
	tude and ADF	
	bearings	

12. Balloon: Code number 172-1-2 Serial number DRS 716, No. 3



complete sketch showing location of equip.

Balloon	235 00
FAA Termination Timer	
Parachute	15.75
Instrumentation (Litton)	27.50
Ballast	13.50 3.7% GW
Scientific package	58.50
Other (Gondola & radar target)	16.50
Gross Weight	366.75
Free Lift	44.00
Gross Inflation	410.75
Helium used	6,223 ft³

Remarks:

FAA termination timer weight included in Litton instrumentation weight. Ballast drop of 13.5 lbs was made 35 minutes after launch at 15,000 ft altitude

On September 4, the skies cleared, but the winds remained upwards of 20 mph. Flight 3011N was cancelled.

We received word that plans to extend the contract past September 9 was being negotiated. Ray Dungan wired to Mr. H. Demboski, ONR Scientific Officer, the contents of a letter (File No. 5003-4(ARW) addressed to Dr. Anderson from Mr. W. E. Fenn, Canadian Regional Director Air Services in Winnipeg. This letter covered the authorization mentioned previously to extend the balloon flights to night flights. His efforts to contact Mr. Demboski were unsuccessful. A flight NOTAM was filed for 0400 on September 5.

On September 5 the crew arrived at the launch area at 0100 local time. Launch conditions were ideal. Flight 3011N was successfully launched at 0415. The balloon ascended at a low rate, averaging 415 fpm to 33,300 ft. then 60 fpm to 36,000 ft at which time the system started a slow descent to impact. An on-the-spot recheck was made of the helium calculations and they appeared OK. Apparently the balloon had a leak.

Authorization to fly the night flights was received from Mr. Demboski and T. O'Malley of Litton advised us that we had received an indefinite extension in time beyond September 9.

The launch NOTAM for flight 3012N was filed for the morning of September 6.

1. Company Litton Systems, Inc. Flight number 3012 N

2. Scientist Dr. Kinsey Anderson Organization University of California

3. Launch: Site Flin Flon Municipal Airport Date/time 8 September 1964 0427 CDT
Technique platform--hand launch Director Ray Dungan

4. Weather: clear; +8°C; calm high Tropopause: Height 40 000 Temp -52°C
(sky-temp-wind-press)

5. Balloon Ceiling: Theoretical 2.5 Mbs 134, 250 ft. Actual: 130, 900 ft. 2.9 Mbs
How altitude determined B-35 Baro-transmitter altitude sensing device

6. Ascent: Surface to tropopause 1040 fpm. Tropopause to ceiling 904 fpm.

7. Flight duration: Total 16 hrs. 10 min. At ceiling 12 hrs. 54 min.

8. Termination: Time 0039 Z Altitude 116, 800 ft. Cause mechanical timer

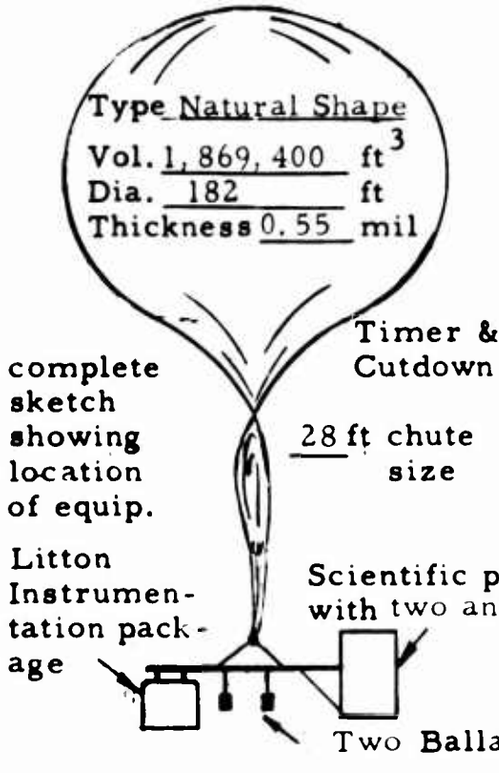
9. Balloon destruction - confirmed unknown--solid overcast--balloon equipped with rip panel
(visual - unknown - etc.)

10. Impact: Date/time 9 September 1964 0137 Z Location unknown--bezring ADF 078° from launch site

11. Frequency used:

(kcs, Mcs)	(purpose)	(Total Time)
1730 kcs	to determine	16 hrs 10 min.
	altitude and ADF	
	bearings	

12. Balloon: Code number 172-1-2 Serial number DRS 716 No. 2



complete sketch showing location of equip.

size

Balloon	234.00
FAA Termination Timer	
Parachute	16.75
Instrumentation (Litton)	28.00
Ballast (2 drops)	21.00 5.6%GW
Scientific package	58.50
Other (Gondola & radar target)	16.00
Gross Weight	374.25
Free Lift	45.00
Gross Inflation	419.25
Helium used	6 352 ft3

Remarks:

Scientific package with two antennas

FAA termination timer weight was included in Littor instrumentation weight. Ballast drops of 10.5 lbs each were made at 20 000 ft and 100 minutes from launch.

All through the evening of September 5 and the morning of September 6, G. Parks and R. Dungan monitored the weather. At 0400 on September 6, due to high winds of 20 to 30 mph, they cancelled Flight 3012N. At 0110 it began to cloud over and later on in the morning snow fell in the Flin Flon Area.

At about noon G. Parks requested that we prepare for a high altitude flight on September 7 instead of the low altitude flight planned. This was done.

The original ballasting plan of making "one" ballast drop by timer if the flight did not exceed 20,000 ft within 40 minutes (avg. ascent rate of 500 fpm) or positively making the drop by pressure switch at 70,000 ft if it did not happen below the 20,000 ft level was changed to positively making "two" ballast drops—one drop controlled by pressure switch at 20,000 ft and the second, controlled by a timer, 100 minutes after launch. This plan was in effect for the remaining four flights. It was thought that the additional ballast drop above the tropopause would assist the early morning flights to ceiling before sunrise.

For the try at launching flight 3012N during the morning on September 7, the crew was at the field at midnight. Skies were clear and surface winds were 6 to 8 mph. G. Parks advised R. Dungan that he would be agreeable to either a high or low altitude flight. R. Dungan decided on the low altitude flight. For five hours we tried to lay out the balloon, but gusty wind conditions kept us from doing so. Finally at 0630, after filing a delay NOTAM, we cancelled the flight.

It would have been possible to launch in the afternoon—conditions were right—but there were no balloon beacon lights.

We refiled a NOTAM to launch a high altitude flight, 3012N, at 0430 on September 8.

On September 8, we were at the launch area by 0030, the skies were clear and surface conditions calm. Occasionally clouds appeared but dissipated rapidly. Everything went smoothly, and with help from the University

of California people, Flight 3012N was successfully launched at 0427. The two programmed ballast drops appeared to be just right. The flight had an average ascent rate of 911 fpm to 130,900 ft. After 4-1/2 hours at 130,000 ft, the flight started a slow descent down to 116,800 where it terminated. Thunderstorm activity was noticeable in the area, and it is thought the storms had something to do with the balloon's slow, premature descent to 116,800 ft.

The University of California group received good data.

Later in the afternoon, G. Parks told R. Dungan that he wanted to fly a high altitude package on a 111-1-2 balloon. We already had a 111-1-2 balloon set for a low altitude flight and, therefore, had to make a few changes to accommodate the high altitude package. Later in the evening, it started to rain and the weather was not shaping up favorably for the morning flight. However, clearance was filed for flight 3013N for the morning of September 9.

1. Company Litton Systems, Inc Flight number 3015 N

2. Scientist Dr. Kinsey Anderson Organization University of California

3. Launch: Site Flin Flon Municipal Airport Date/time 11 September 1964 0025 CDT
platform--
Technique hand launch Director Ray Dungan

4. Weather: calm; +5° C; Northwest 6 to 8 knots; high Tropopause: Height 30,000 Temp -48° C
(sky-temp-wind-press)

5. Balloon Ceiling: Theoretical 5.58 Mbs 115,500 ft. Actual: 112,500 ft. 6.36 Mbs
How altitude determined B-35 Baro-transmitter altitude sensing device

6. Ascent: Surface to tropopause 906 fpm. Tropopause to ceiling 940 fpm.

7. Flight duration: Total 17 hrs. 23 min. At ceiling 14 hrs. 25 min.

8. Termination: Time 2149 Z Altitude 95 600 ft. Cause mechanical timer
unknown--cloud cover and distance out too

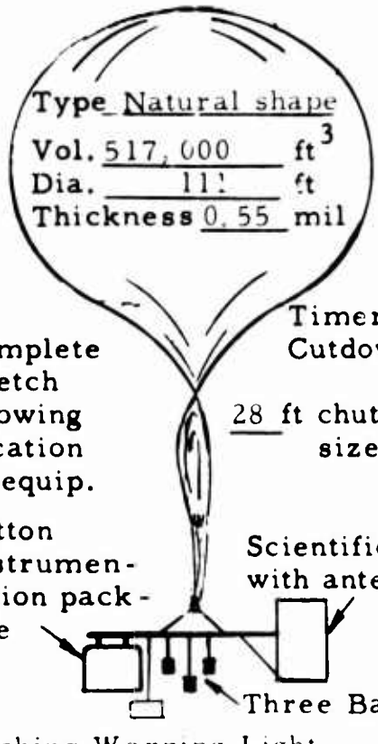
9. Balloon destruction - confirmed great--balloon equipped with rip panel destruction
(visual - unknown - etc.) device

10. Impact: Date/time 11 September 1964 2248 Z Location A bearing of 080° from launch site

11. Frequency used:

(kcs, Mcs)	(purpose)	(Total Time)
1730 kcs	determine altitude and ADF bearings	17 hrs 23 min

12. Balloon: Code number 111-1-2 Serial number DRS 715 (No. 4)



complete sketch showing location of equip.

Balloon	110.00
FAA Termination Timer	
Parachute	17.00
Instrumentation (Litton)	28.00
Ballast	27.00 10.6%GW
Scientific package	55.00
Other (Gondola & Beacon light)	18.25
Gross Weight	255.25
Free Lift	30.75
Gross Inflation	286.00
Helium used	4 333 ft³

Remarks:

The weight of the FAA termination timer is included in the Litton instrumentation weight. The high altitude scientific package was flown on this low altitude flight for the purpose of obtaining more data. The high altitude package and gondola added 43 lbs to the payload weight

It rained all day on September 9. Flight 3013N was cancelled at about 0330. The balloon beacon lights arrived from the University of California on September 9, and we were now able to launch in the afternoon. Later in the evening of September 9, we filed a NOTAM for a launching of Flight 3013N at 0430 on September 10.

About 2330 on September 9 it began to snow in the area and continued through the night. At 0330 on September 10, Flight 3013N was cancelled. Before noon it started to clear and turned into a real fine day.

In a telephone conversation with Mr. Brereton of ATC at Winnipeg, R. Dungan learned that he was already aware of plans for extending the operation past September 9. On the night flights, Mr. Brereton advised that we could turn the beacon light off whenever the flight was above 44,000 ft. We filed a launch NOTAM for Flight 3013N at 2130 on September 10.

Earlier in the evening the weather alternated from rain to clear skies. A two-hour delay to launch at 2330 was filed. At approximately 2200, the crew moved out to the field and began laying out. Preparations were slow and necessitated another delay until 0030. Winds were 8 to 10 mph throughout the field preparations. At 0025 (local time) on September 11, Flight 3013N was successfully launched in 6 to 8 mph winds with gusts to 12 mph. Humidity was high and skies were clear.

Three ballast drops were made on this flight: First at 20,000 ft by pressure switch; Second by timer, at 100 minutes after launch and Third by timer at 3-1/2 hours after launch.

Throughout the flight RDF bearings were obtained, but cloud conditions allowed only two theodolite readings at about 0700.

At 1939, altitude data received indicated termination of flight 3013N.

1. **Company** Litton Systems Inc. **Flight number** 3015 N

2. **Scientist** Dr. Kinsey Anderson **Organization** University of California

3. **Launch: Site** Flin Flon Municipal Airport Manitoba, Canada **Date/time** 16 September 1964 0454 CST

Technique platform-hand launch **Director** Ray Dungan

4. **Weather:** clear; +10°C; South 4 knots; high **Tropopause: Height** 46,000 **Temp** -55°C
(sky-temp-wind-press)

5. **Balloon Ceiling: Theoretical** 4.59 Mbs 120,000 ft. **Actual:** 117,750 ft. 5.11 Mbs
How altitude determined B-25 Baro-coder altitude sensing device

6. **Ascent: Surface to tropopause** 867 fpm. **Tropopause to ceiling** 868 fpm.

7. **Flight duration: Total** 14 hrs. 36 min. **At ceiling** 11 hrs. 9 min.

8. **Termination: Time** 9/17/64 0012 Z **Altitude** 115,250 ft. **Cause** mechanical timer unknown--balloon out of visual range--

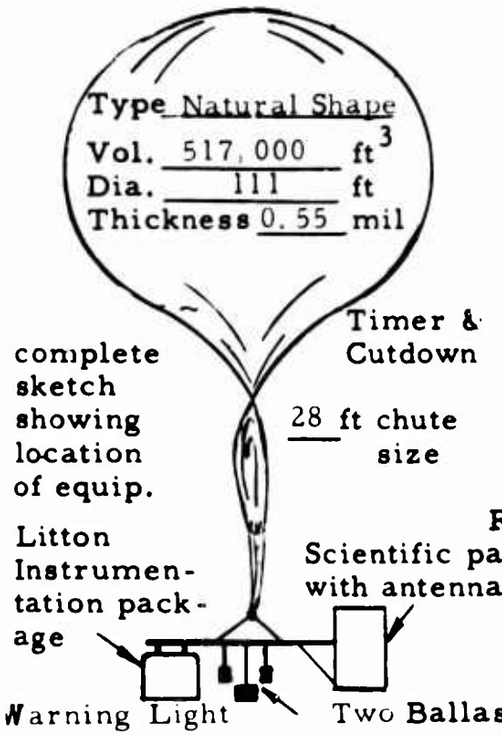
9. **Balloon destruction - confirmed** balloon equipped with rip panel
(visual - unknown - etc.)

10. **Impact: Date/time** 9/17/64 0130 Z **Location** unknown--bearing 70° from launch site

11. **Frequency used:**

(kcs, Mcs)	(purpose)	(Total Time)
1730 kcs	determine altitude	14 hrs. 36 min
	and ADF	
	bearings	

12. **Balloon: Code number** 111-1-2 **Serial number** DRS 715 Balloon No 6



Balloon	107.00
FAA Termination Timer	
Parachute	17.25
Instrumentation (Litton)	30.00
Ballast	11.00 5.6%GW
Scientific package	21.25
Other (Gondola & radar target)	9.75
Gross Weight	196.25
Free Lift	23.55
Gross Inflation	219.80
Helium used	3,333 ft³

Remarks:
Scientific package with antenna

On September 12, we received word from Minneapolis that we were to remain in the field and launch the remaining two 111-1-2 balloons. Equipment from the recovery of Flights 3006N and 3008N were to be checked and prepared fro the last two flights. We were also advised that these flights were not to be flown unless good weather and magnetic activity occurred simultaneously. Dr. Anderson also advised G. Parks similarly by telephone.

The weather on the evening of September 11 was favorable for Flight 3015N, but no magnetic activity was evident at that time.

At 2200 on September 12, no magnetic activity was evident and the flight was cancelled for the morning of September 13.

On the evening of September 13 and the morning of September 14, weather conditions for launching were good, but there was no magnetic activity.

Mr. Don Morrison from the University of Saskatchewan, operator of the magnetometer, reported no magnetic activity on September 14, and at 2200 George Parks advised us not to launch on September 15.

On September 15 the weather forecaster at Winnipeg gave us a 50-50 chance for a flight in the morning of September 16. G. Parks gave us a "go-ahead" at about midnight.

On September 16, Flight 3015N was launched at 0454 with surface winds at 5 mph and a clear sky. At 0600 we took one theodolite bearing; due to the broken sky conditions additional theodolite bearings were not possible RDF bearings were taken throughout the day. Flight 3015N terminated at 1812.

The University of California group was happy about the information they collected on Flight 3015N. G. Parks advised R. Dungan they would be ready for the last launching at 0200 on September 17.

Throughout the day September 16, preparations were made for flight 3016N. Due to the early anticipated launch we added another ballast drop to the system. The system then consisted of the first drop at 20,000 ft. second drop at 100 minutes after launch, and a third drop 4 hours after launch.

1. Company Litton Systems, Inc. Flight number 3016 N

2. Scientist Dr. Kinsey Anderson Organization University of California
Flin Flon Municipal Airport

3. Launch: Site Manitoba, Canada Date/time 17 September 1964, 0144 CST
platform,
Technique hand launch Director Ray Dungan

4. Weather: partly cloudy; +13°C; calm; high Tropopause: Height 46,000^{est} Temp -55°C
(sky-temp-wind-press)

5. Balloon Ceiling: Theoretical 4.5 Mbs 120,400 ft. Actual: 80,000 ft. 28 Mbs
How altitude determined B-35 Baro-transmitter altitude sensing device

6. Ascent: Surface to tropopause 980 fpm. Tropopause to ceiling 630 fpm.

7. Flight duration: Total 3 hrs. 59 min. At ceiling none hrs. none min.

8. Termination: Time 0934 Z Altitude 80,600 ft. Cause Balloon leak

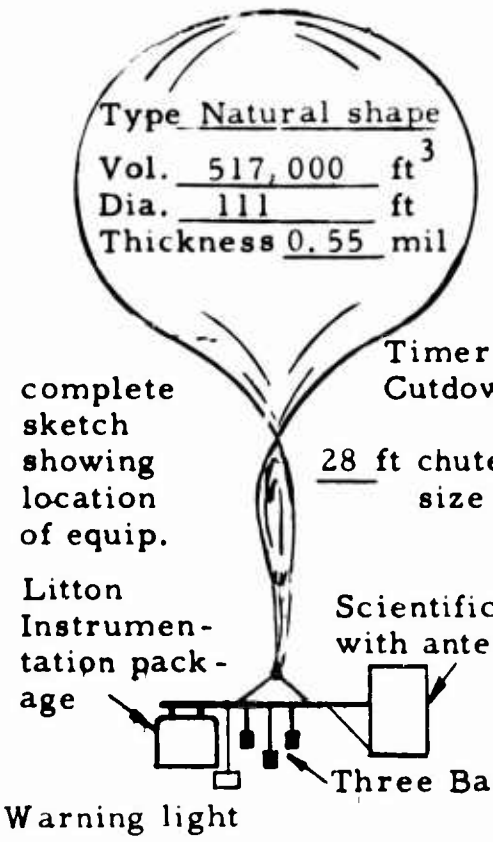
9. Balloon destruction - confirmed unknown--balloon descended to ground
(visual - unknown - etc.)

10. Impact: Date/time 17 September 1964 1143 Z Location unknown--a bearing of 90° from launch site

11. Frequency used:

(kcs, Mcs)	(purpose)	(Total Time)
1730 kcs	determine altitude and ADF bearings	3 hrs 59 mins.

12. Balloon: Code number 111-1-2 Serial number DRA 715, Balloon No. 1



Balloon	112.00
FAA Termination Timer	
Parachute	15.00
Instrumentation (Litton)	28.00
Ballast	22.00 9.5%GW
Scientific package	21.50
Other (Gondola & radar target)	10.00
Gross Weight	208.50
Free Lift	25.00
Gross Inflation	233.50
Helium used	3,538 ft^3

Remarks:

FAA termination timer is included in Litton instrumentation weight.

For the launching of Flight 3016N—planned for 0200 on September 17—the crew arrived at the launching site at 2200 on September 16.

At 0144, September 17, Flight 3016N was launched successfully. Surface and sky conditions were good. The flight ascended to the tropopause (46,000 ft) at 980 fpm, and then from 46,000 ft to its maximum altitude of 80,400 ft at 630 fpm. At this point, it started a slow descent to impact. During the flight few RDF bearings were taken, and it was too cloudy for theodolite bearings.

All indications are that at some point around 76,000 ft, the balloon developed a leak. Later in the month Flight 3016N was found and recovered by Mr. Jim Muskego of Wabowden, Manitoba. Mr. Harvey Henderson of Wabowden assisted in initiating return of the equipment to Minneapolis.

Table 2. Summary

1964 Flin Flon Flights

Flight No.	Date	Launch Time (CDT)	Ascent Rate (fpm)	Time Thru 100 k (CDT)	Duration Above 100 k	Float Alt. K	Duration at Float (hrs)
3006 N	8-23	0643	590-83	1110	9 hr 02 m	110-100	7 hr 35 m
3007 N	8-25	0429	860-400	0704	12 hr 39 m	131-121	10 hr 00 m
3008 N	8-26	0500	500-0	----	----------	-------	----------*
3009 N	8-27	----	-----	----	----------	-------	----------**
3010 N	8-28	0444	1100-700	0633	11 hr 57 m	116-94	11 hr 02 m
3011 N	9-5	0415	600-0	----	----------	------	----------***
3012 N	9-8	0427	1100-550	0605	13 hr 36 m	130-117	13 hr 00 m
3013 N	9-11	0025	1000-600	0207	13 hr 38 m	112-93	14 hr 25 m
3015 N	9-16	0454	1100-800	0641	11 hr 30 m	117-115	11 hr 12 m
3016 N	9-17	0144	1100-0	----	----------	-------	----------****

* Adverse launch conditions, lost lift, max. alt. 16K
** Adverse launch conditions, Rupture in launch arm
*** Lost lift, max. altitude 36K
****Lost lift, max. altitude 81K

Return Home

After the launching of Flight 3016N on September 17, Litton's field crew immediately began preparing all equipment for the return to Minneapolis. Mr. Bowers, ONR Resident Representative at Minneapolis, had previously procured GBL's for the return of all equipment.

On September 10, all preparations for departure from the Flin Flon area by Litton and the University of California were complete.

Four of the University of California personnel, driving two vehicles, left on the morning of September 18. In the afternoon of September 18, Ray Dungan, M. Lueders, and Gene Minnich of Litton and three University of California personnel left on the Trans Air commercial flight.

D. Ballast Discussion

Up until the time that operations commenced at Flin Flon, all flights had been planned as strictly daylight flights, and in order to minimize system size, ballast provisions were made only for the ascent phase of the flights. All flights were equipped with a ballast control which would drop ballast if the flight did not exceed 20,000 feet within 40 minutes, or by pressure switch control at 70,000 feet if it was not dropped below 20,000 feet. This system was employed on the first five flights.

After arrival at Flin Flon, flight arrangements were changed to provide flights at night. Ballasting provisions were accordingly changed in the field within the limitations of the equipment available. It was decided to make a drop of ballast at 20,000 feet by pressure switch control only and to utilize the timer control for one or two more drops at higher altitudes during ascent or float after expiration of a time interval from the launch time. This system, although possibly not ideal, was considered to be the optimum that could be accomplished with the ballast control equipment that was originally designed for the day flights. The summary of the ballast programming and flight results are given in Table 3.

Table 3

Flight Number	Number of Drops	Pressure Switch Control	Timer Control	Remarks
3006 N Plan I	One 5.25 lb	192 minutes after launch @ 63,800 ft		Increased rate of rise 60% from 230 fpm to 368 fpm
3007 N Plan I	One 10.5 lb	110 minutes after launch @ 70,000 ft		No marked changes in the rate of ascent
3008 N Plan I	One 5.25 lb		40 minutes after launch @ 14,650 ft	14,650 ft was the highest altitude attained
3010 N Plan I	One 5.25 lb	79 minutes after launch @ 70,000 ft		No marked change in the rate of ascent
3011 N Plan I	One 13.5 lb		40 minutes after launch @ 19,250	Increased rate of rise 68% from 457 fpm to 770 fpm. 36,000 ft was the highest altitude attained
3012 N Plan II	Two 10.5 lb each	10.5 lb 18 minutes after launch @ 20,000 ft	10.5 lb 100 minutes after launch @ 104,600 ft	No significant change in balloon performance
3013 N Plan II	Three 6.7 lb 6.7 lb 13.5 lb	6.75 lb 22 minutes after launch @ 20,000 ft	6.75 lb 90 minutes after launch @ 88,400 ft 13.5 lb 215 minutes after launch 110,200 ft	No significant change noted after each of the 6.75-lb drops. The flight was floating level at 110,200 ft when the 13.5-lb drop was made and as a result it ascended to 113,000 ft, then started a slow descent to a lower level

Table 3 (continued)

Flight Number	Number of Drops	Pressure Switch Control	Timer Control	Remarks
3015 N Plan II	Three 5.5 lb 5.5 lb 11 lb	5.5 lb 22 minutes after launch @ 20,000 ft	5.5 lb 100 minutes after launch @ 93,500 ft 11 lb 240 minutes after launch @ 114,500 ft	No significant change noted after each of the 5.5-lb drops. The flight was floating level at 114,500 ft when the 11-lb drop was made and as a result it ascended to 115,750 ft and floated
3016 N Plan II	Three 5.5 lb 5.5 lb 11 lb	5.5 lb 20 minutes after launch @ 20,000 ft	5.5 lb 100 minutes after launch @ 80,400 ft	First drop - rate of ascent increased from 100 fpm to 1020 fpm. Second drop was made with no no noticeable change in balloon performance at the maximum altitude, 80,400 ft, at which the flight was rounding off prior to descent. The third drop was not made.

IV. CONCLUSIONS AND RECOMMENDATIONS

Planning and preparations for the operation were satisfactory.

No provision for recovery of the payload was made in this program, however some trajectories were quite short and it was apparent that a tracking aircraft based at Flin Flon could have tracked and recovered some payloads. In general, it would appear than when weather is locally adequate for balloon launching, it is adequate for aircraft tracking in at least the local area and therefore recovery potential for flights which have short trajectories is quite high with a single light float plane.

Tracking by the theodolite observation and radio direction finder bearings gave surprisingly good results for the flight durations and trajectory distances in this operation. The theodolite elevation angles with balloon at float, gave good track information that could be extrapolated when the balloon was lost from sight. On days when the theodolite observations could not be obtained estimates of wind from previous flights and weather bureau data combined with radio direction finder information gave a fair degree of confidence in the estimated balloon position with an accuracy that was felt to be adequate for aircraft clearance purposes in the Canadian hinterland. It was evident however, that for purposes of payload recovery these methods are definitely inadequate and that a radio cross-bearing would be required during descent to give a sufficiently accurate indication of impact area.

Current inflation and launch bubble procedures are limited to 8 kts of wind to reliably avoid damage to the balloon bubble by wind action. Chance of damage to the balloon bubble increases rapidly as wind goes above this figure.

The anchor-line-dolly launching technique appeared to be excellent for the light weight systems involved and at no time during the nine launchings were any serious problems encountered.

Of the ten flights attempted, six were operationally successful. The attached table (Table) summarizes the balloon performance. The balloon rate of rise was less than desirable on early flights and was corrected by use of greater free lift on subsequent flights. Float altitude variations occurred which appear to correlate quite well with heavy cloud cover beneath the balloons indicating that controlled ballasting provisions are needed if close altitude retention is essential for the scientific experiment. For flights launched at night, a satisfactory, although not necessarily optimum, ballasting schedule was developed in the field. Of the four unsuccessful flight attempts, two were made when the scientific urgency justified flight attempts under normally unacceptable surface wind conditions with the result that one balloon failed in the platform and the other apparently developed a serious leak. Of the other two flights which failed, one balloon appeared to be leaking from the time of launch and the other apparently developed a leak at altitude. No bursts were experienced.

Recommendations for Future Operations

1. That assignment of a light float aircraft for tracking and recovery of flights with short trajectories be considered.

2. That provision for balloon position fixinb by radio cross-bearings be made if longer duration and/or trajectory flights are contemplated.

3. That the same procedures for GBL's, custom clearances, etc., be employed.

4. That the field engineer make personal contact with the key Canadian personnel well in advance of the operation. This prcedure immeasurably aided this operation in establishing good working relationships with Canadian personnel.

5. That the use of GMD - Radiosonde tracking equipment be investigated to determine applicability to this type operation.

6. That use of a C-47 or equivalent aircraft equipped with aerial recovery gear be studied for possible savings in total program costs.

7. That information which has been developed in various research programs pertinent to prediction of balloon performance as affected by free lift, ballasting, thermal effects, etc., be correlated and published.

8. The launch areas currently available at the Flin Flon airport are adequate to accomodate launches in any direction up to a maximum balloon volume of 3 million ft^3. For larger sizes, launch directions would be limited. However, the area could be made adequate for all launches with a small amount of grading and use of large tarpaulins and long helium hoses.

APPENDIX A

TABULATION OF BALLOONS, CONTROL INSTRUMENTS AND SUPPORT EQUIPMENT LIST FOR FLIN FLON, 1964

A. MISCELLANEOUS ITEMS:

No.	Quantity	Item
1.	10	28 ft orange and white parachutes, 8 with chute cable, load release line, anchor release line and load ring
2.	4	high altitude gondola frames
3.	6	low altitude gondola frames
4.	1	high pressure helium hose
5.	4	ground clothes
6.	1	folding table
7.	2	folding chairs
8.	2	helium gauges
9.	4	thermometers
10.	1	helium manifold with "tee" fitting for two gauges
11.	1	100' anchor line
12.	6	111-1-2 balloons
13.	4	172-1-2 balloons
14.	2	26-tube helium trailers
15.	1	gray panel truck
16.	1	launch platform
17.	6	rolls of 890 tape
18.	1	18" pipe wrench
19.	1	24" pipe wrench
20.	1	nail puller
21.	1	bell jar, stand, hose and cable

No.	Quantity	Item
22.	1	Wallace and Tiernan absolute pressure gauge
23.	2	boxes of pibals
24.	3	hard hats
25.	1	First Aid kit
26.	2	rolls 4" poly tape
27.	2	rolls 2" poly tape
28.	11	casters for balloon layout cart
29.	1	1/8" nico press swedging tool
30.	1	balloon layout roller
31.	6 or 8	end rolls of poly
32.	50	1/8" nico press sleeves
33.	1	quick-release peg board
34.	1	vacuum pump
35.	1	gallon vacuum pump oil
36.	2	100 lb bags of steel shot ballast
37.	1	roll of 200 lb test nylon
38.	1	roll 1/8" galvanized aircraft cable
39.	2	rolls of 1000 lb test nylon
40.	2	flashlights
41.	1	1/4" drive drill motor
42.	1	1/2" drive drill motor
43.	1	clip board
44.	25	helium sheets
45.	1	150 lb platform scale

No.	Quantity	Item
46.	1	tripod for theodolite
47.	1	theodolite
48.	2	Simpson meters
49.	1	heater
50.	1	field glasses
51.	1	1/2" drill motor
52.	1	1/4" drill motor
53.	1	set of fraction drill bits
54.	1	hot plate
55.	1	log chain
56.	1	chain binder
57.		300 lbs of ballast
58.		tool box
59.		soldering iron
60.		solder
61.		assorted screws
62.		tape, electrical
63.		phone headsets (2)

B. INSTRUMENTS*

No.	Quantity	Item
1.	6	B-35's (ser. #001-006); recovered 005 and 006
2.	2	B-25's (ser. #017 and 027)
3.	2	T-12's (ser. # V and 038)
4.	8	S-15's (ser. #001, 003, 005, 007-012) recovered 007 and 009
5.	8	24 v supply
6.	8	7.5 v with timer (24 hr)
7.	8	antenna balls, 1730 kc
8.	8	door springs
9.	8	red instrument bags (2 recovered)
10.	6	B-35 cable
11.	2	T-12, B-25 cables
12.	8	sets 5k squibbs
13.	8	S-15 cables
14.	8	ballast squibbs
15.	2	anchor line cables attached to anchorlines
16.	8	chute cables
17.	8	sets release squibbs
18.	8	sets anchor line release squibbs

in chutes

*Two B-35 (005 and 006), two S-15 (007 and 009) and two red instrument bags were the only instruments and equipment recovered. All other items under instruments were expended.

C. INSTRUMENT SPARE PARTS

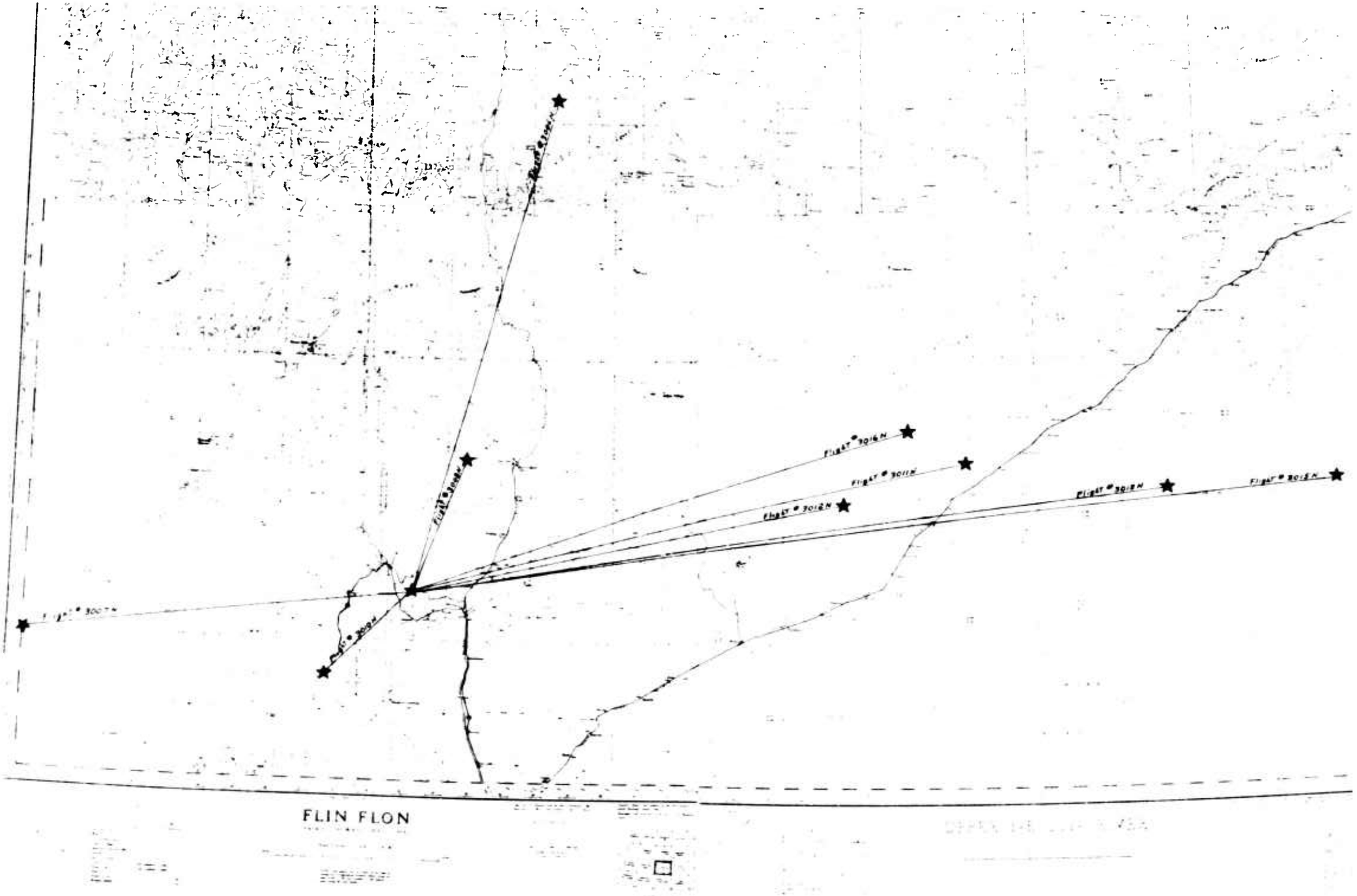
No.	Quantity	Item
1.		2 amp fuses (2 sizes)
2.		2N 1908 power transistors
3.		amphenol plugs (assorted)
4.		timers (2 hr, 12 hr, 24 hr)
5.		
6.		xtals (1750 and 1730)
7.		squibbs
8		3 wire cable
9.		#20 wire, 1 roll
10.		ground strap
11.		solder lugs
12.		RF output meter, 2 meg
13.		Simpson-multimeter
14.		1N536 diodes
15.		#520 Eveready
16.		#560 Eveready, 7.5 v
17.		#560 battery terminals
18.		24 v test bulbs
19.	1	roll 8222 wire (720)

D. COMMUNICATIONS EQUIPMENT

No.	Quantity	Item
1.		SP-600 receiver
2.		Viking II transmitter
3.		35' whip antenna
4.		RG-8' coas feeder
5.		2" x 4" mount for antenna
6.		ground plane wires
7.		BC 348 receiver
8.		2 speakers
9.	1	microphone (for Viking)
10.		24 v power supply for ARN-6
11.		output meter
12.		12 v power supply for morrow
13.		2 ARN 6 receiver
14.	1	Morrow transceiver
15.		6 meg whip
16.		2 meg antenna
17.		Spare parts fuses tubes coax coax connectors extension cords

APPENDIX B

FLIGHT PROFILES AND A MAP SHOWING THE ESTIMATED IMPACT OF FLIGHTS

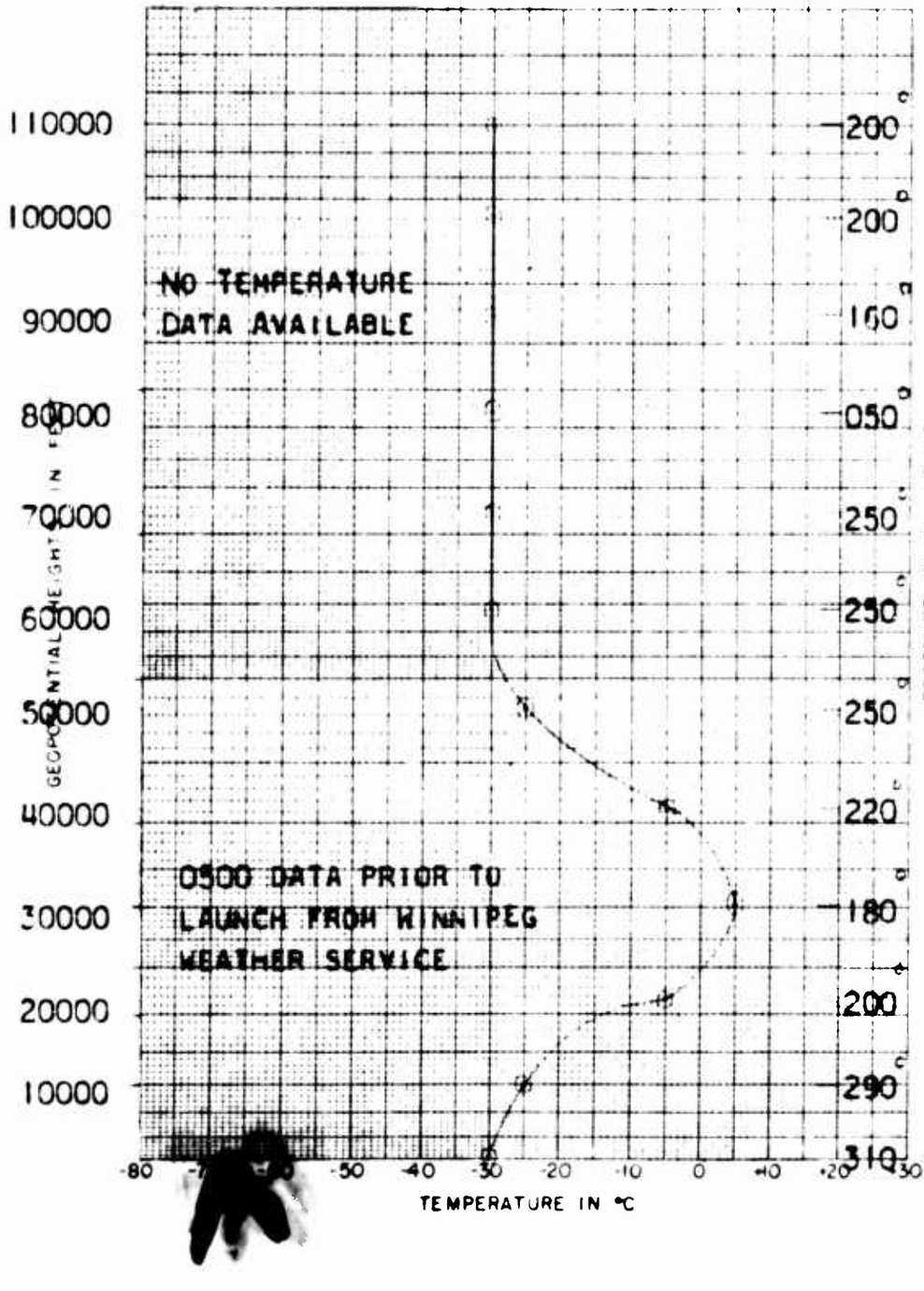

FLIN FLON

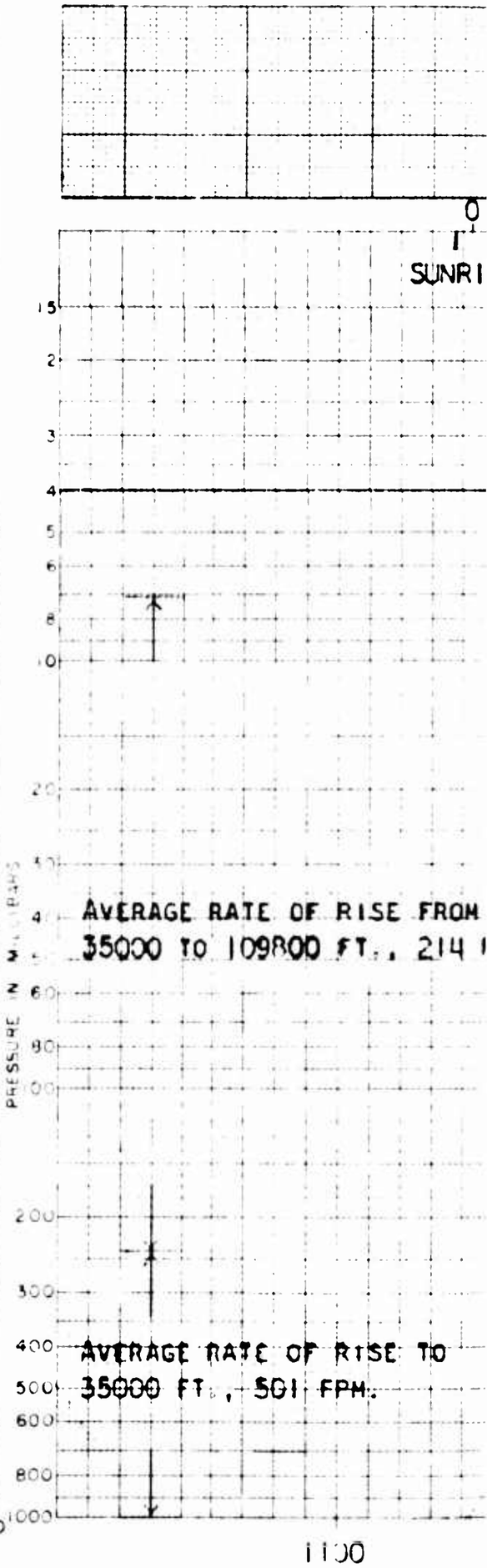
FLIGHT NO. 3006 N DATE 23 AUGUST, 1964
FOR 55053
LOAD ON BALLOON 76.25 LBS.
FREE LIFT 13 LBS= 7 %
BALLOON TYPE NUMBER MATERIAL WEIGHT
111 1 2 DRS 715 2 .5 MIL. 109 LBS.

ALTITUDE DATA

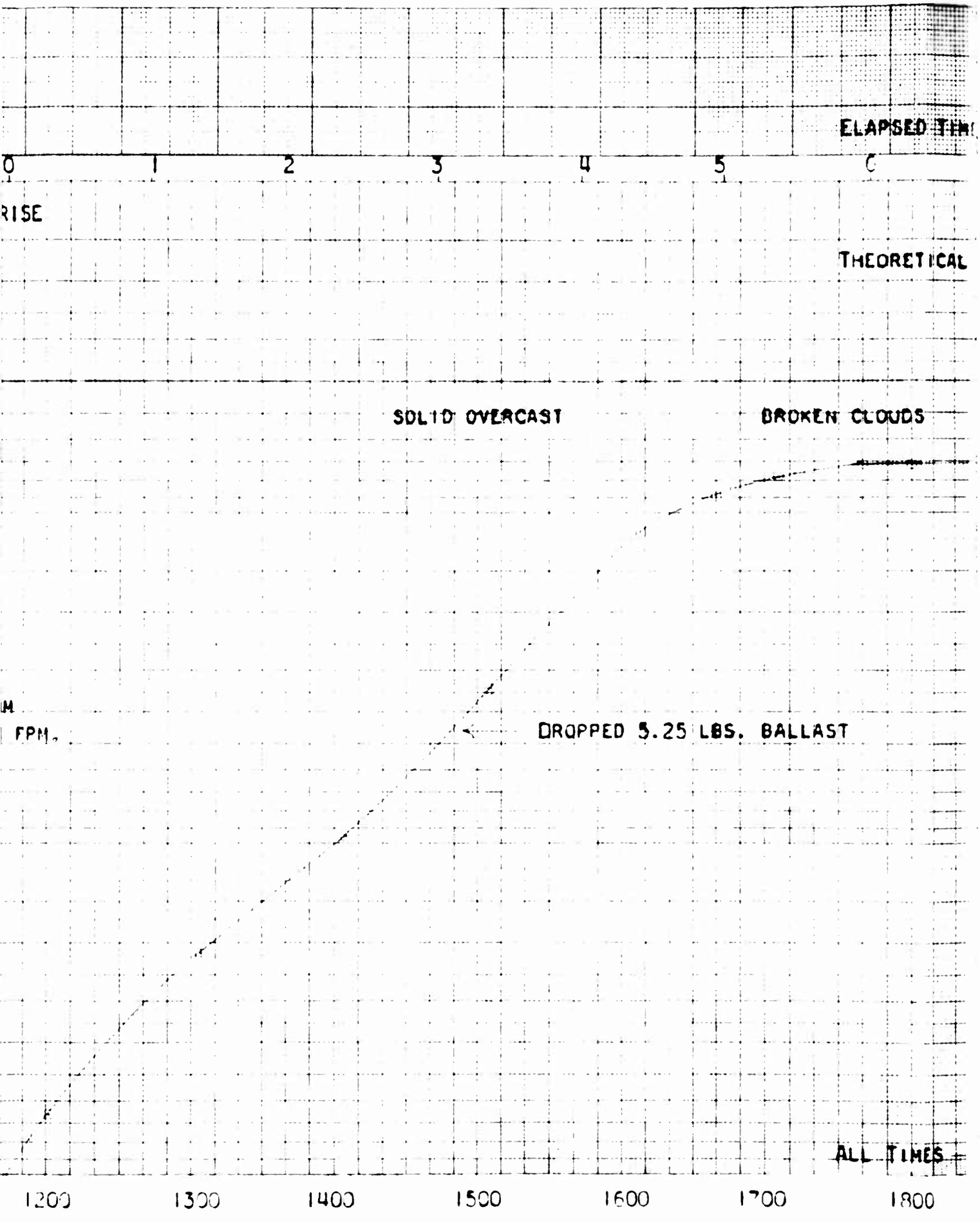
WIND DATA

KNOTS 0 10 20 30 40 50

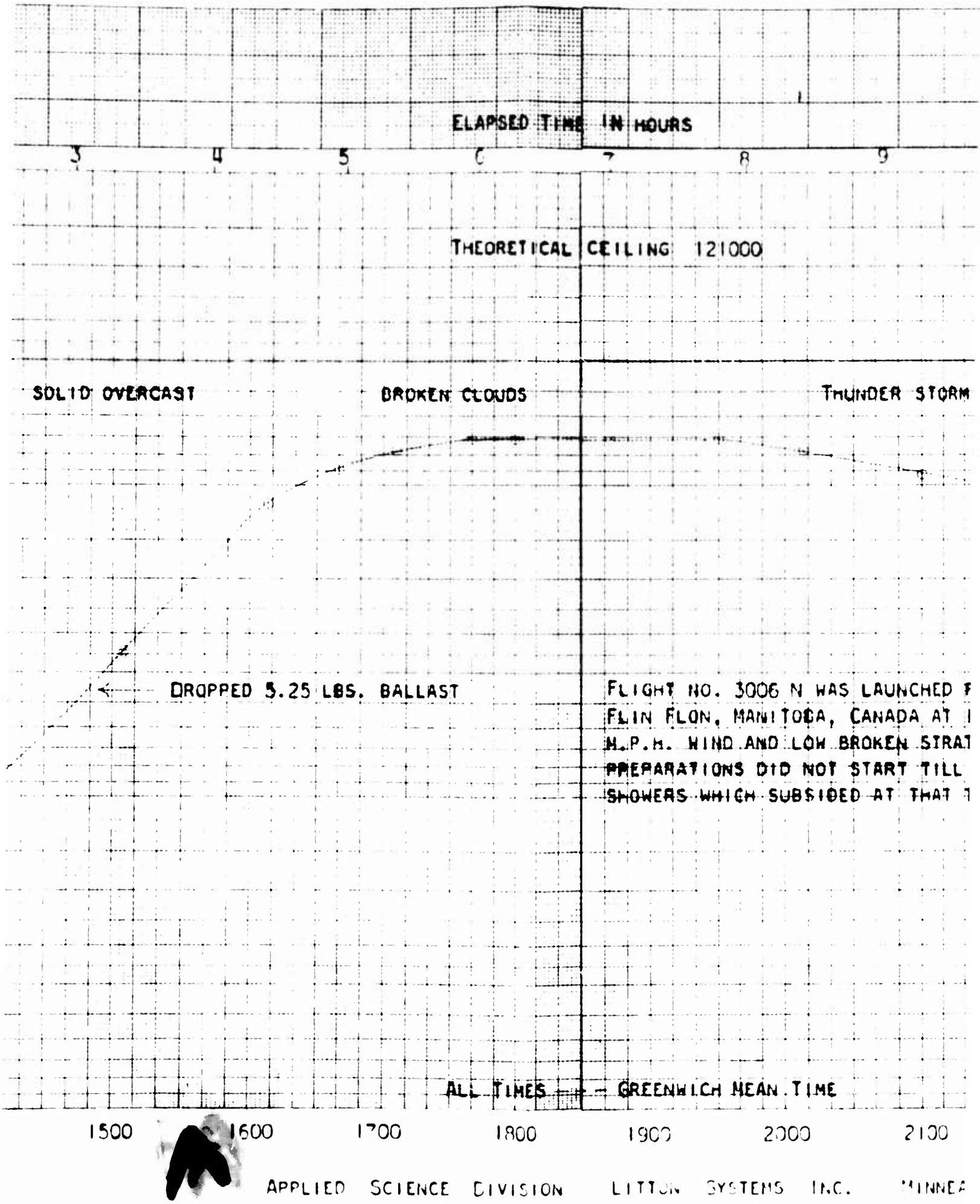


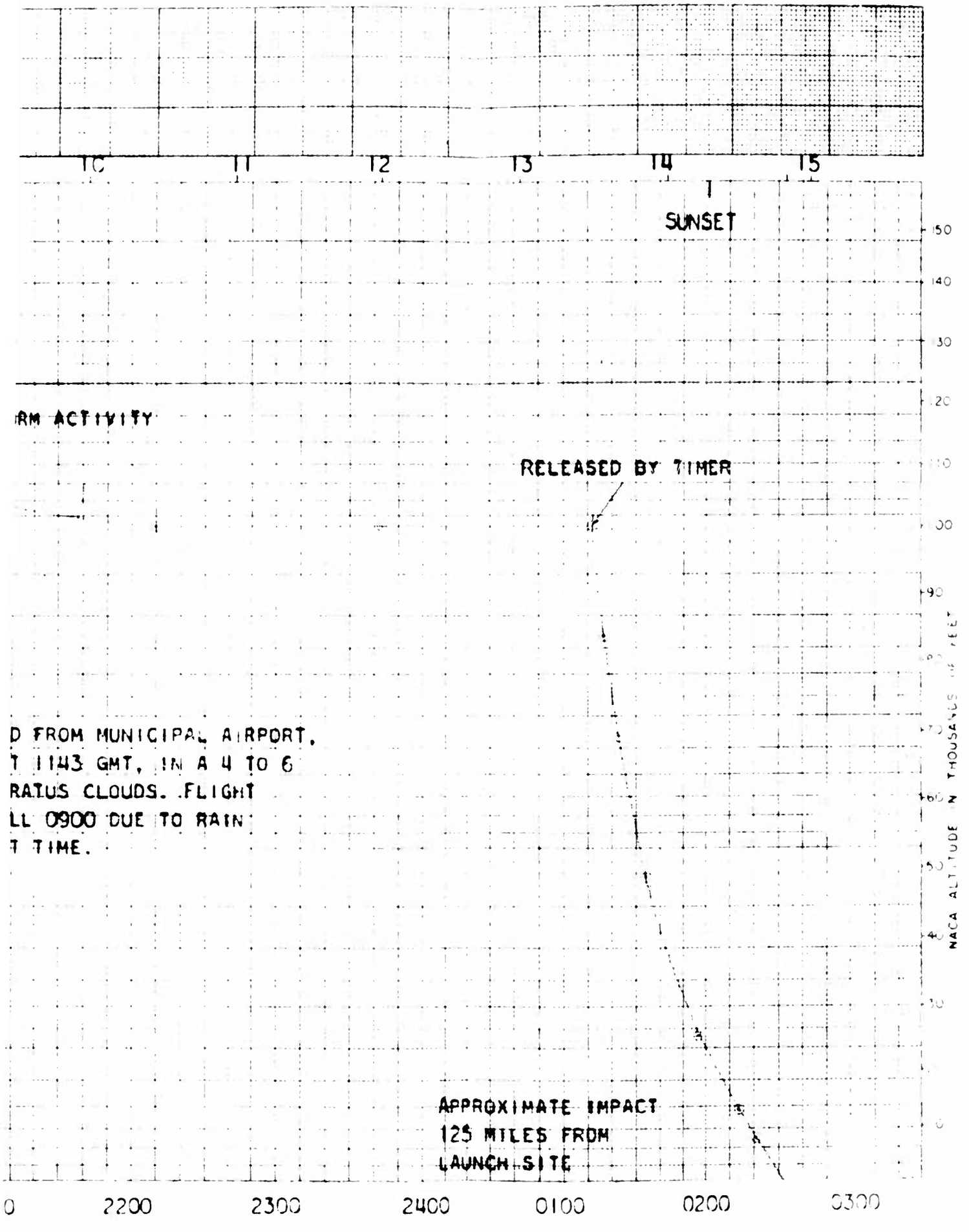


1100



APPLIED SCIENCE DIVISION


ELAPSED TIME IN HOURS
3
4
5
6
7
8
9
THEORETICAL CEILING 121000
SOLID OVERCAST
BROKEN CLOUDS
THUNDER STORM
DROPPED 5.25 LBS. BALLAST
FLIGHT NO. 3006 N WAS LAUNCHED F
FLIN FLON, MANITOBA, CANADA AT
M.P.H. WIND AND LOW BROKEN STRAT
PREPARATIONS DID NOT START TILL
SHOWERS WHICH SUBSIDED AT THAT T
ALL TIMES — GREENWICH MEAN TIME
1500
1600
1700
1800
1900
2000
2100



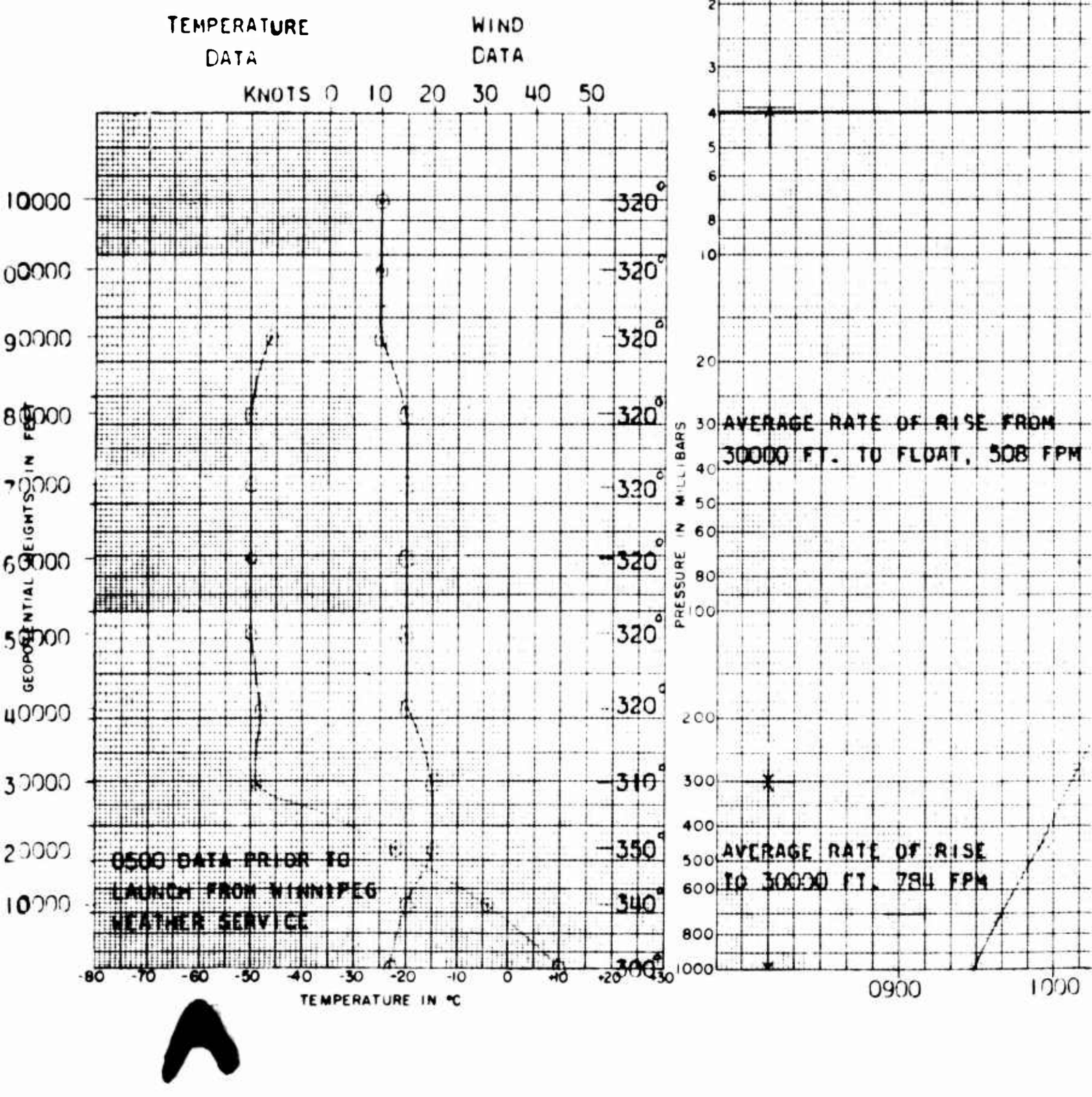
NEAPOLIS, MINNESOTA

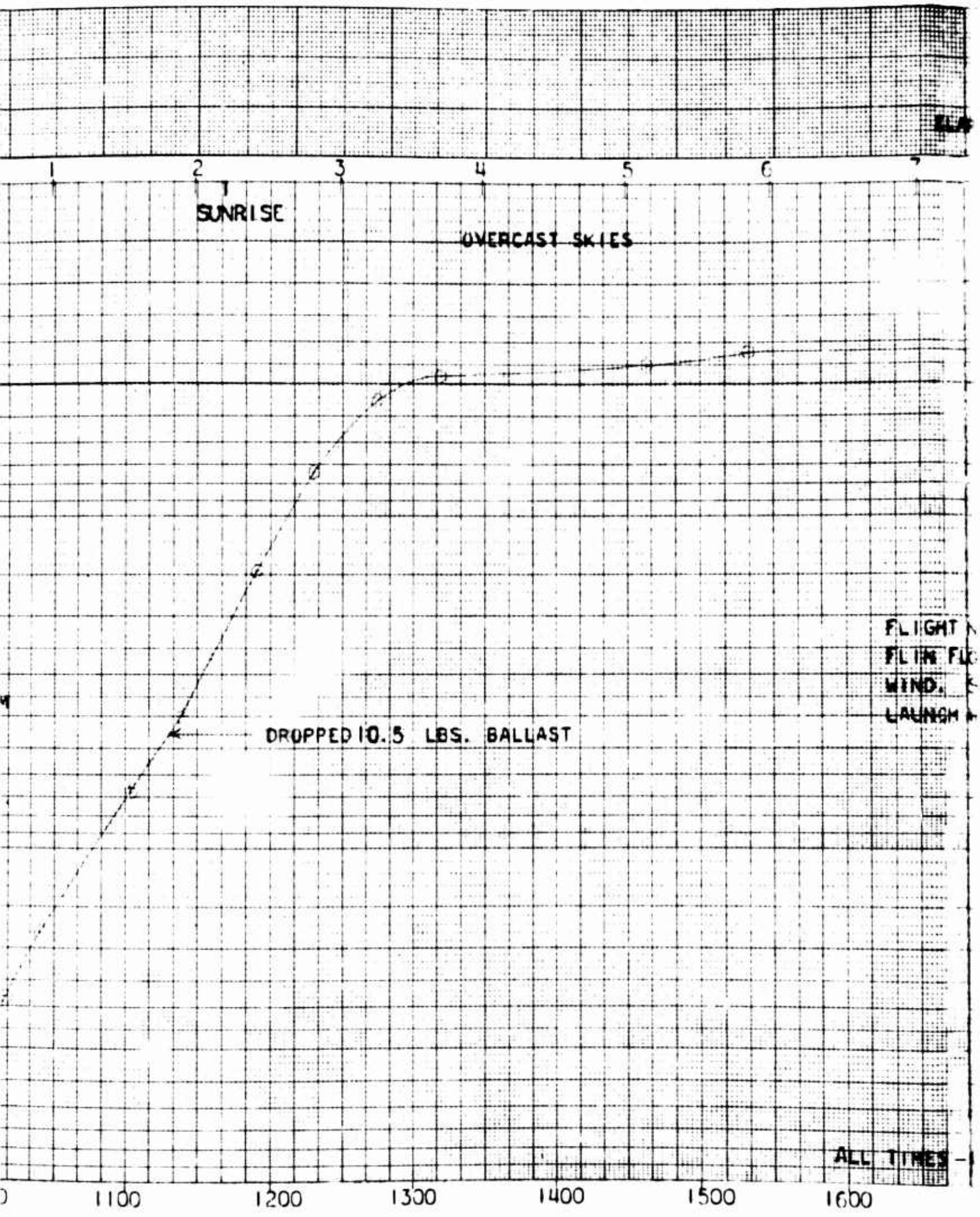
MOB DECEMBER 8, 1964

FLIGHT NO. 3007N DATE 25 AUGUST 1964
FOR 55053
LOAD ON BALLOON 128 LBS.
FREE LIFT 34.5 LBS= 9 %

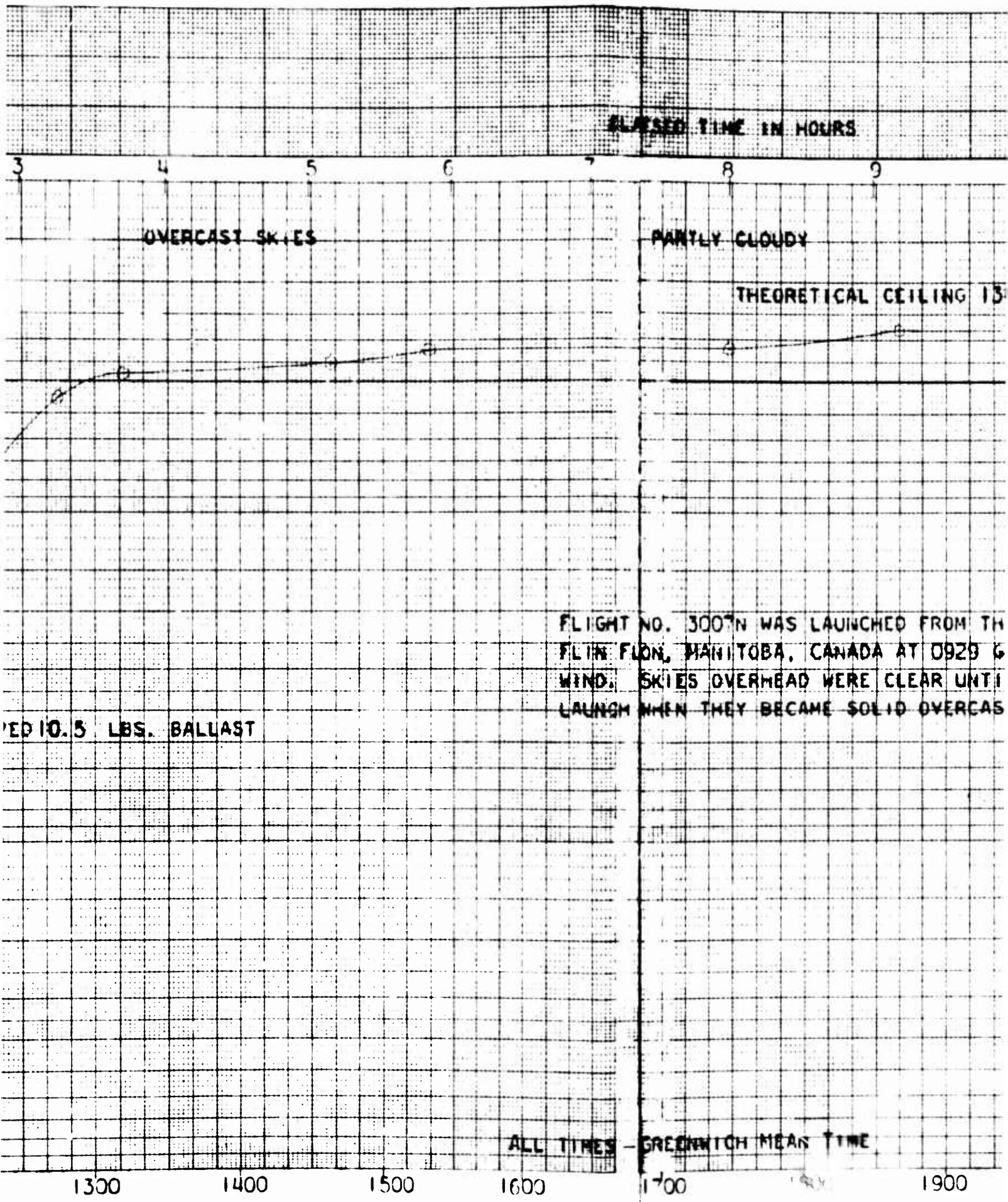
BALLOON TYPE	NUMBER	MATERIAL	WEIGHT
172-1-2	DRS-716-4	.5 MIL	234 LBS.

ALTITUDE DATA

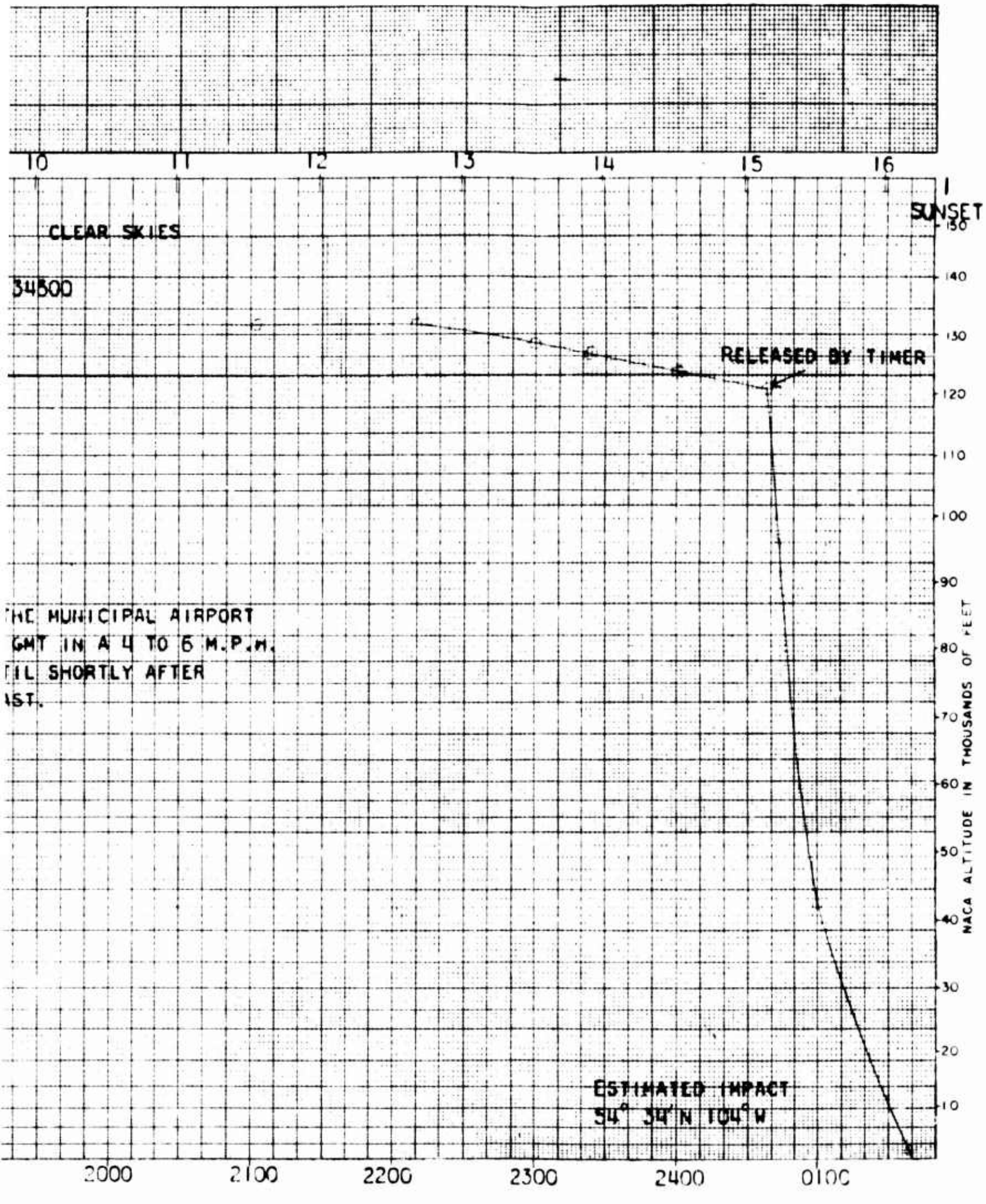




APPLIED SCIENCE DIVISION LITTON SYSTEMS


ELAPSED TIME IN HOURS
3
4
5
6
7
8
9
OVERCAST SKIES
PARTLY CLOUDY
THEORETICAL CEILING 13
FLIGHT NO. 300?N WAS LAUNCHED FROM TH
FLIN FLON, MANITOBA, CANADA AT 0929 G
WIND. SKIES OVERHEAD WERE CLEAR UNTI
LAUNCH WHEN THEY BECAME SOLID OVERCAS
ED 10.5 LBS. BALLAST
ALL TIMES - GREENWICH MEAN TIME
1300
1400
1500
1600
1700
1900

B



A

MOB DECEM[illegible] 1, 1964

FLIGHT NO. 3008 DATE 26 AUG. 1964
FOR 55053
LOAD ON BALLOON 70 LBS.
FREE LIFT 18.5 LBS= 10 %
BALLOON TYPE NUMBER MATERIAL WEIGHT
111-1-2 DRS 715 3 .5 MIL. 109 LBS.

ALTITUDE DATA

TEMPERATURE DATA

WIND DATA

KNOTS 0 10 20 30 40 50 60

100000
90000
80000
70000
60000
50000
40000
30000
20000
10000

270°
270°
320°
320°
320°
290°
290°
290°
270°
230°
160°

0500 DATA PRIOR TO FLIGHT FROM WINNIPEG WEATHER SERVICE

TEMPERATURE IN °C

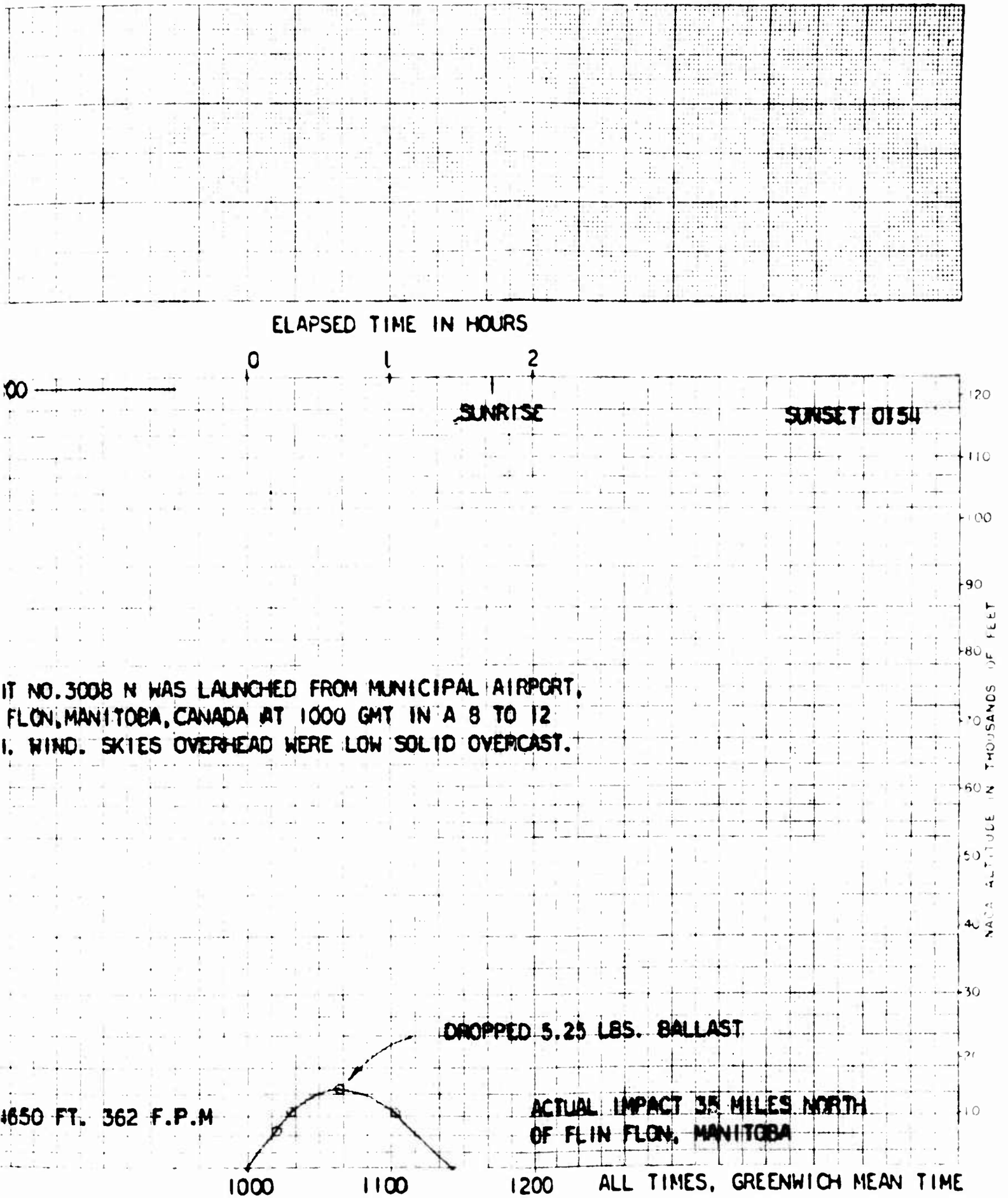
THEORETICAL CEILING 121,000

FLIGHT
FLIN FI
M.P.H.

AVERAGE RATE OF RISE TO 146

APPLIED SCIENCE DIVIS

9203 80-



IT NO.3008 N WAS LAUNCHED FROM MUNICIPAL AIRPORT,
FLON, MANITOBA, CANADA AT 1000 GMT IN A 8 TO 12
I. WIND. SKIES OVERHEAD WERE LOW SOLID OVERCAST.

4650 FT. 362 F.P.M

ISION LITTON SYSTEMS INC. MINNEAPOLIS, MINNESOTA.

AHF NOV. 4 1964

FLIGHT NO. 3010 N DATE 29 AUGUST, 1964
FOR 55053
LOAD ON BALLOON 78.75 LBS.
FREE LIFT 26.5 LBS= 14 %

BALLOON TYPE	NUMBER	MATERIAL	WEIGHT
111-1-2	DRS-715-5	.5 MIL.	111 LBS.

ALTITUDE DATA

TEMPERATURE DATA

WIND DATA

KNOTS 0 10 20 30 40 50

110000
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000

100°
130°
230°
240°
240°
240°
240°
290°
340°
360°
020°

80 70 60 -50 -40 -30 20 -10 0 +20 +20

TEMPERATURE IN °C

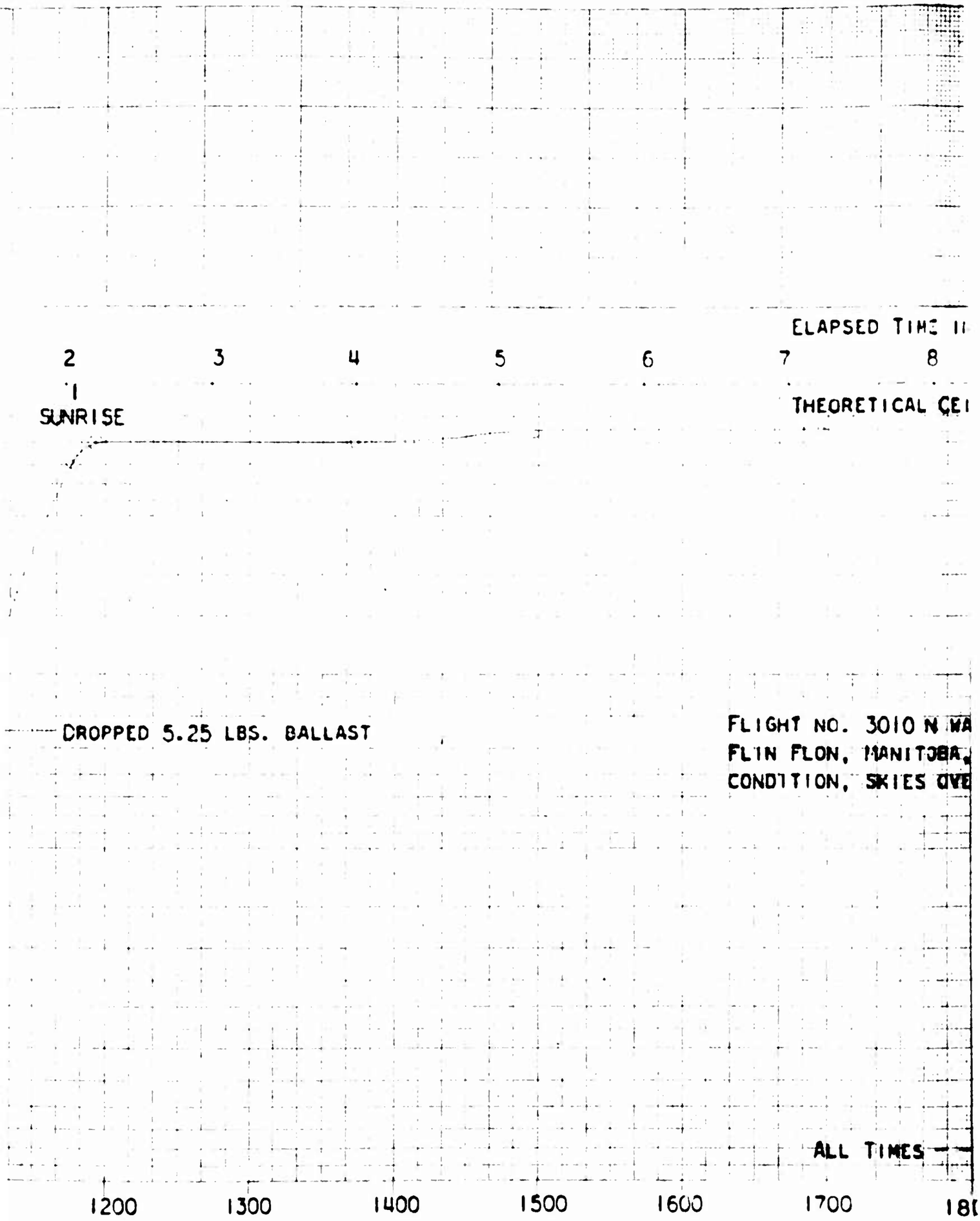
0500 DATA PRIOR TO LAUNCH FROM WINNIPEG WEATHER SERVICE

0 1

AVERAGE RATE OF RISE FROM 40000 TO 116000 FT., 877 FPM.

AVERAGE RATE OF RISE TO 40000 FT., 867 FPM.

0900 1000 1100


ELAPSED TIME II
2
3
4
5
6
7
8
1
SUNRISE
THEORETICAL CEI
DROPPED 5.25 LBS. BALLAST
FLIGHT NO. 3010 N MA
FLIN FLON, MANITOBA,
CONDITION, SKIES OVE
ALL TIMES
1200
1300
1400
1500
1600
1700
181

ELAPSED TIME IN HOURS

4 5 6 7 8 9 10

THEORETICAL CEILING 120600

THUNDE

AST

FLIGHT NO. 3010 N WAS LAUNCHED FROM MUNICIPAL
FLIN FLON, MANITOBA, CANADA AT 0945 GMT IN A CL
CONDITION, SKIES OVERHEAD WERE CLEAR.

ALL TIMES — — — GREENWICH MEAN TIME

1400 1500 1600 1700 1800 1900 200

B

11 12 13 14 15 16 17

SUNSET

IER STORMS

RELEASED BY TIMER

L AIRPORT,
CALM WIND

ESTIMATED IMPACT
102° 12' W. 54° 22' N

000 2100 2200 2300 2400 0100 0200 0300

S, MINNESOTA

MOB DECEMBER 9, 1964

FLIGHT NO. 3011 DATE 5 SEPT. 1964

FOR 55053

LOAD ON BALLOON 131.75 LBS.

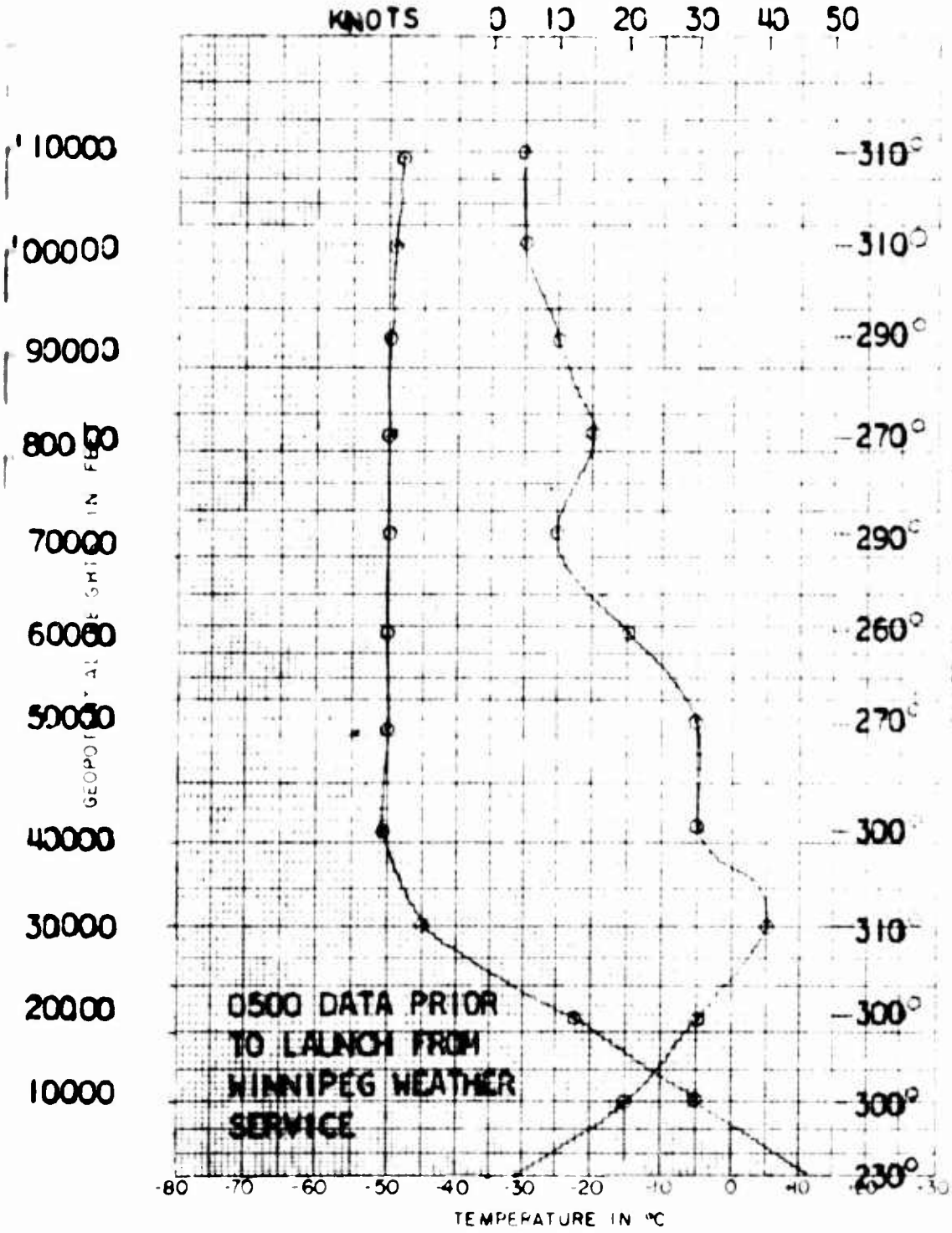
FREE LIFT 44 LBS= 12 %

BALLOON TYPE	NUMBER	MATERIAL	WEIGHT
172-1-2	DRS 716-3	.5 MIL	235 LBS.

ALTITUDE DATA

TEMPERATURE DATA

WIND DATA



AVERAGE RATE OF RISE FROM 33300 FT. TO 36000 FT. 60 F.P.M.

AVERAGE RATE OF RISE TO 33300 FT. 415 F.P.M

09

APPLIED SCIENCE DIV

THEORETICAL CEILING 134250 FT.

0 1 2 3 4

ELAPSED TIME IN HOURS

SUNRISE

SUNSET 0129

FLIGHT NO. 301 IN WAS LAUNCHED FROM MUNICIPAL AIRPORT, FLIN FLON, MANITOBA, CANADA. WIND WAS FROM THE SOUTH WEST, 4 TO 6 M.P.H. SKY WAS CLEAR, AND A HIGH HUMIDITY EXSISTED.

GE

P.M

DROPPED 13.5 LBS. BALLAST

APPROXIMATE IMPACT 98° 24' W 55° 08' N

ALL TIMES GREENWICH MEAN TIME

0900 1000 1100 1200 1400

120 110 100 90 80 70 60 50 40 30 20 10

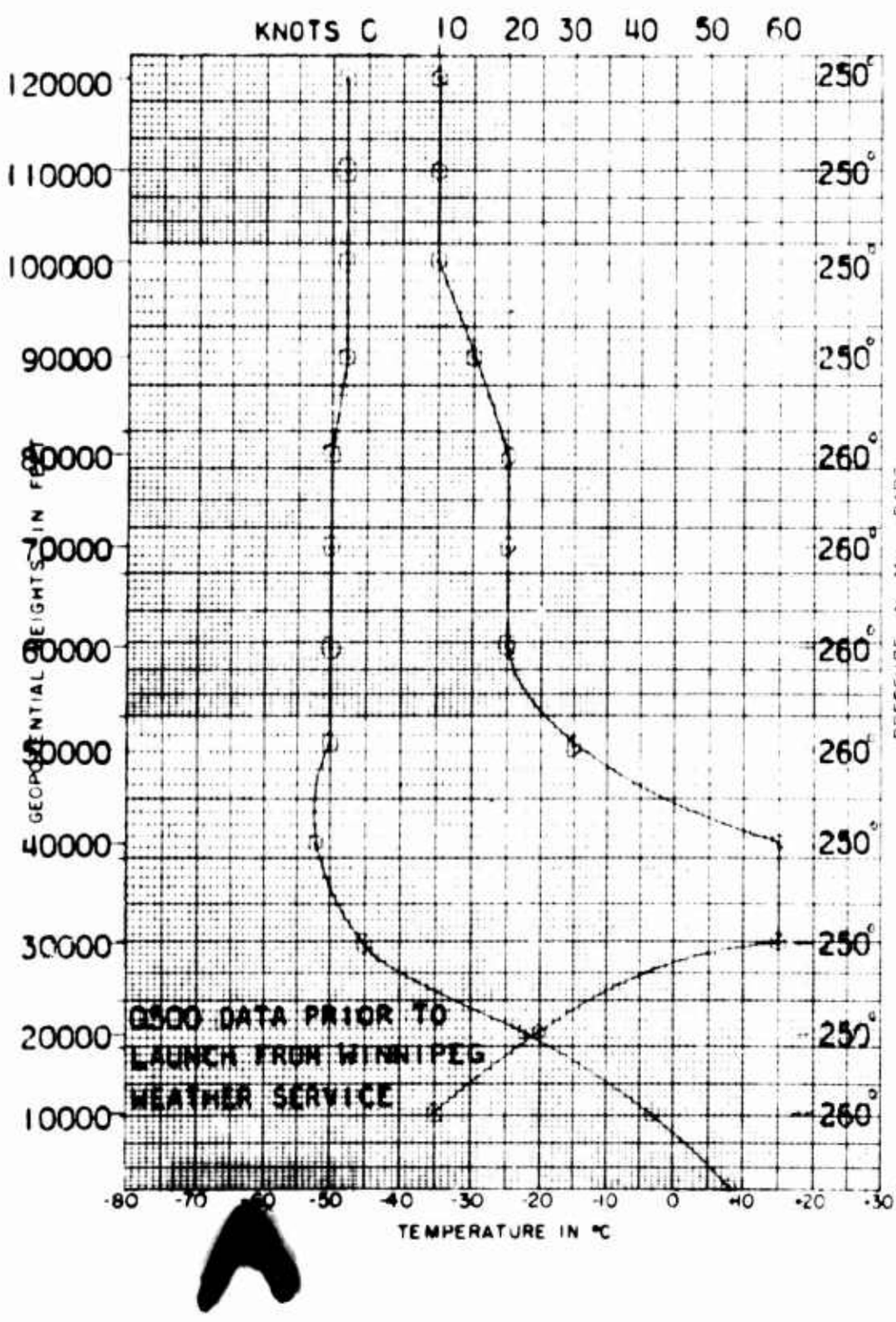
IVISION LITTON SYSTEMS INC. MINNEAPOLIS, MINNESOTA A.H.F. NOV. 8 1964

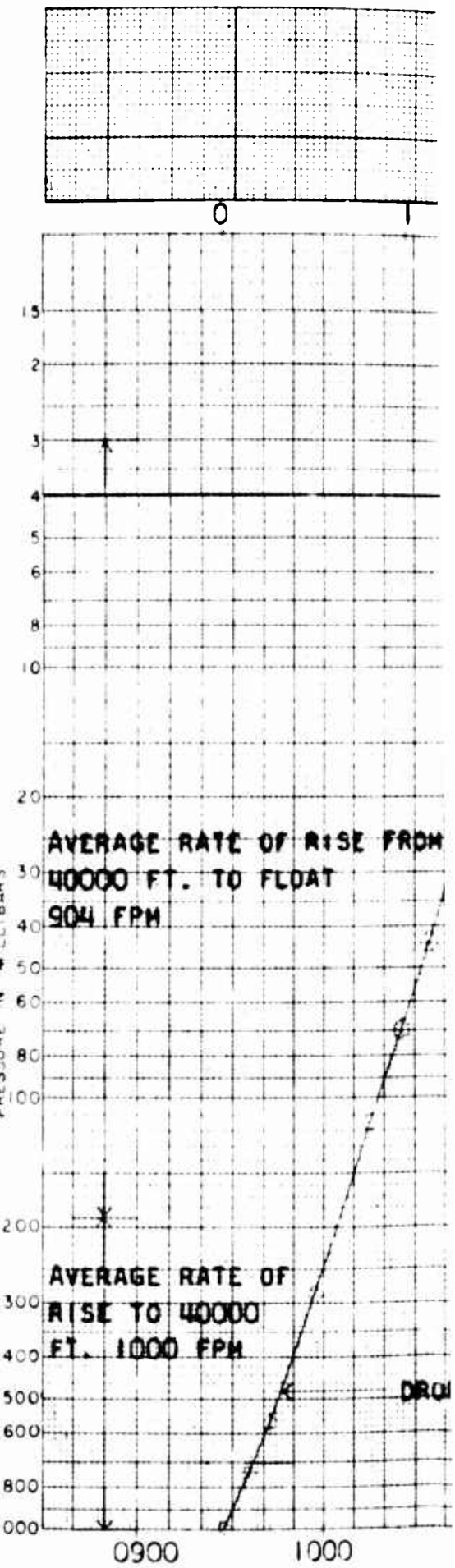
FLIGHT NO. 3012 N DATE 8 SEPTEMBER, '64
FOR 55053
LOAD ON BALLOON 140.25 LBS.
FREE LIFT 45 LBS= 12 %
BALLOON TYPE NUMBER MATERIAL WEIGHT
172-1-2 DRS-716-2 .5 MIL. 234 LBS.

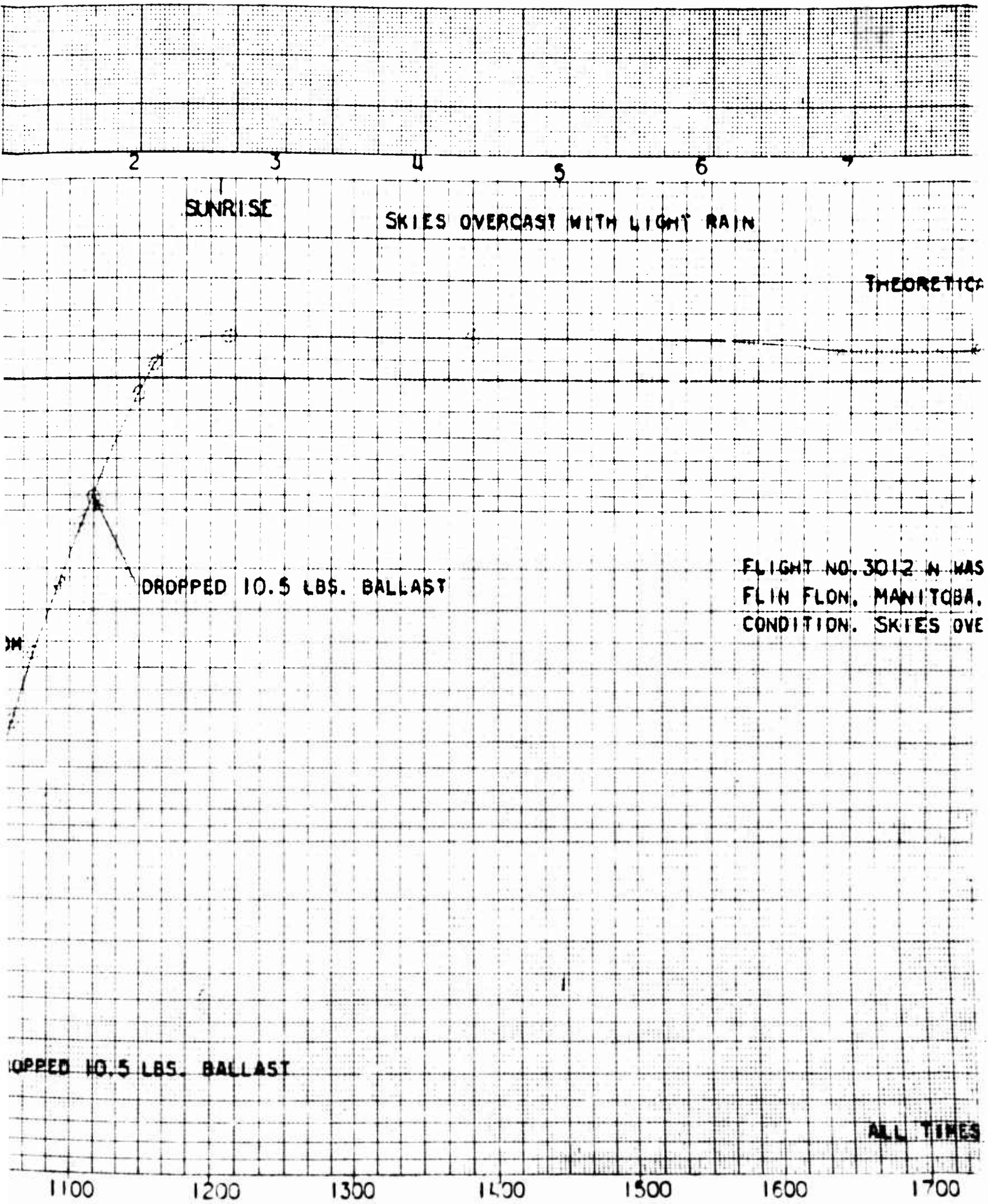
ALTITUDE DATA

TEMPERATURE DATA

WIND DATA






2
3
4
5
6
7
SUNRISE
SKIES OVERCAST WITH LIGHT RAIN
THEORETIC
DROPPED 10.5 LBS. BALLAST
FLIGHT NO. 3012 N WAS
FLIN FLON, MANITOBA.
CONDITION. SKIES OVE
OPPED 10.5 LBS. BALLAST
ALL TIMES
1100
1200
1300
1400
1500
1600
1700

4 5 6 7 8 9 10

SKIES OVERCAST WITH LIGHT RAIN

BROKEN CLOUDS

THEORETICAL CEILING 134300 FT.

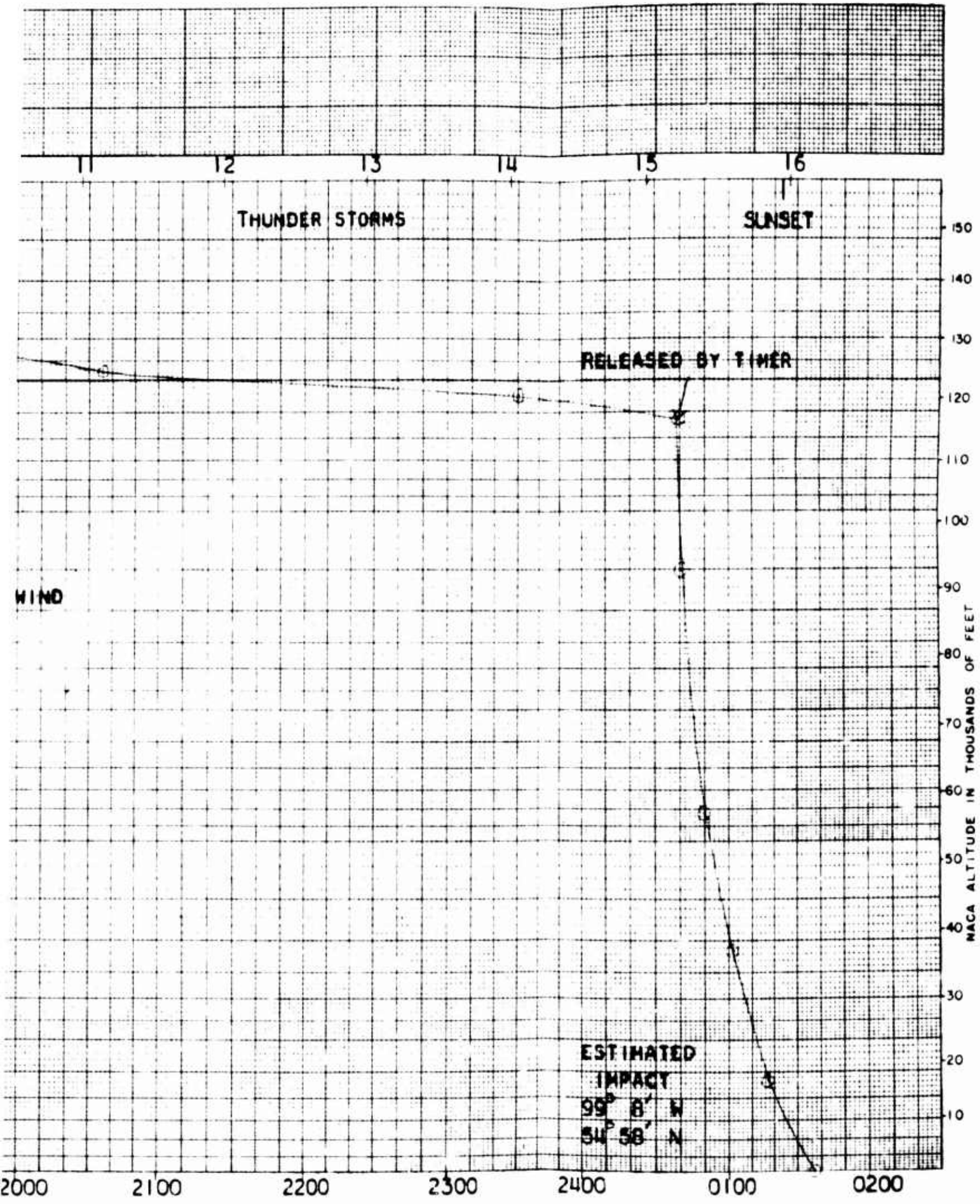
5. BALLAST

FLIGHT NO. 3012 A WAS LAUNCH FROM MUNICIPAL AIRPORT
FLIN FLON, MANITOBA, CANADA AT 0927 GMT IN A CALM W
CONDITION. SKIES OVERHEAD WERE PARTLY CLOUDY.

ALL TIMES - GREENWICH MEAN TIME

1300 1400 1500 1600 1700 1800 1900 20

APPLIED SCIENCE DIVISION LITTON SYSTEMS INC. MINNEAPOLIS, MINNESOTA



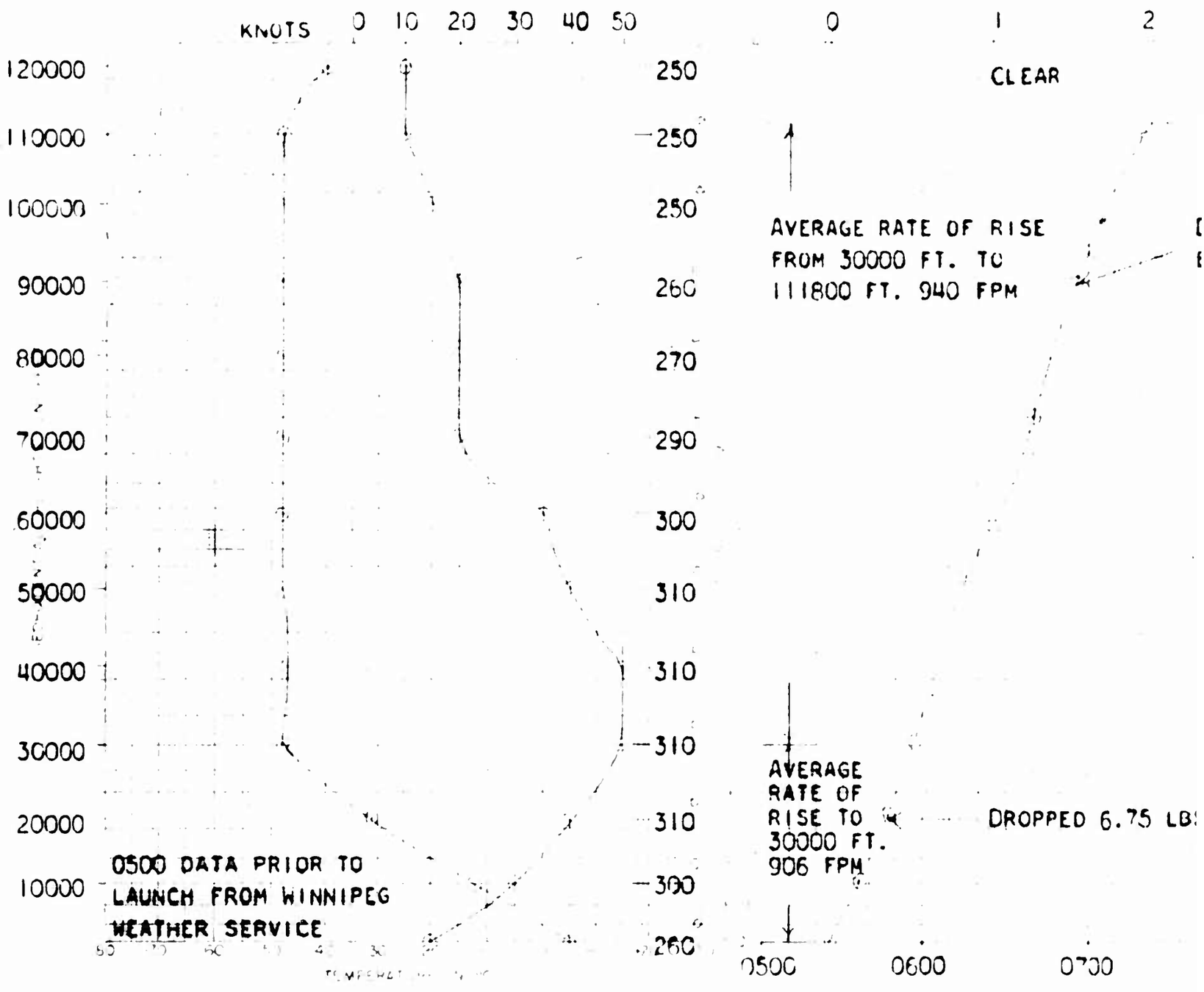
MOB DECEMBER 7, 1964

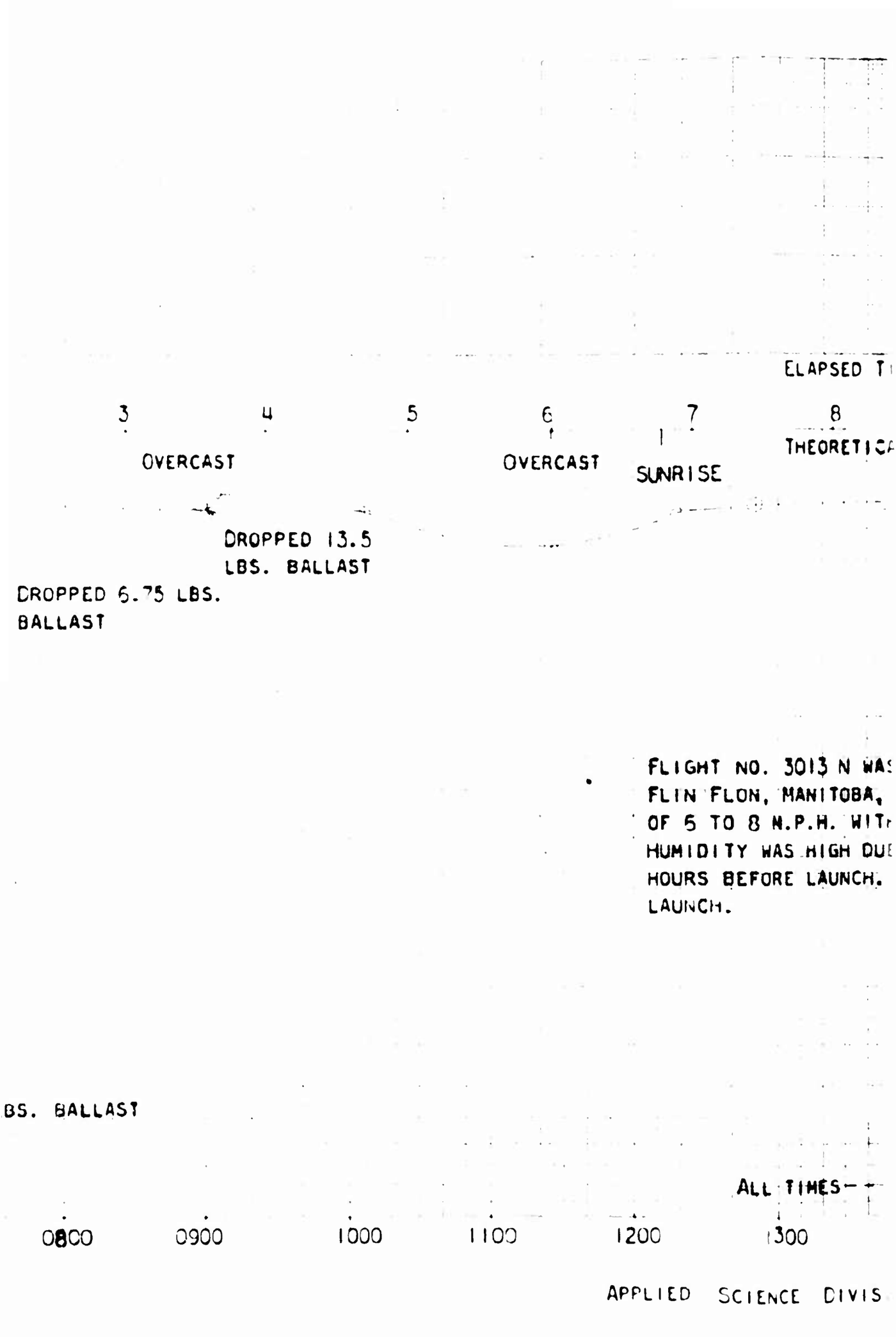
FLIGHT NO 3013 N DATE 11 SEPT. 1964
FOR 55053
LOAD ON BALLOON 145.25 LBS.
FREE LIFT 30.75 LBS 12 %
BALLOON TYPE NUMBER MATERIAL WEIGHT
111 1-2 DRS-715-4 .5 MIL. 110 LBS

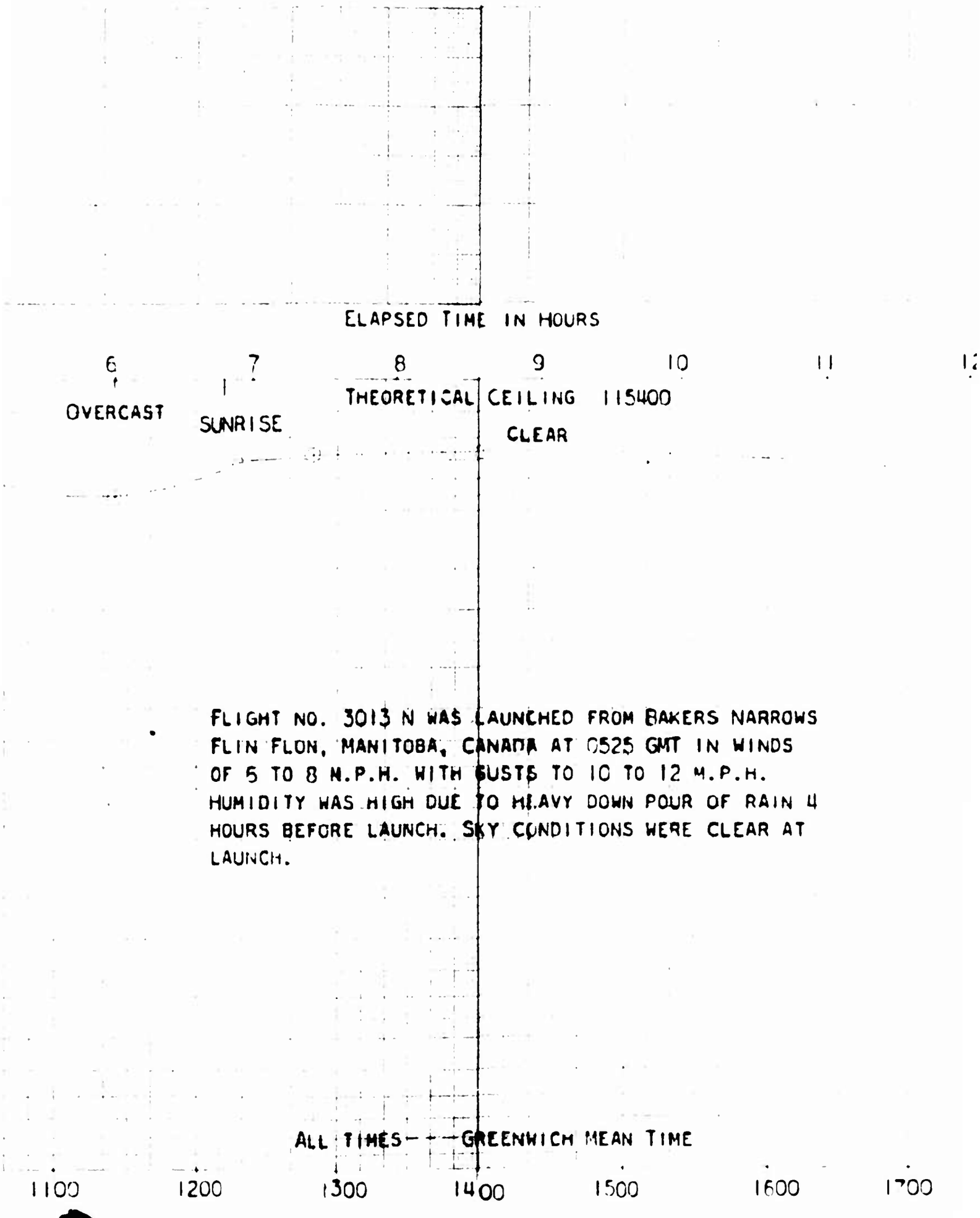
ALTITUDE DATA

TEMPERATURE DATA

WIND DATA

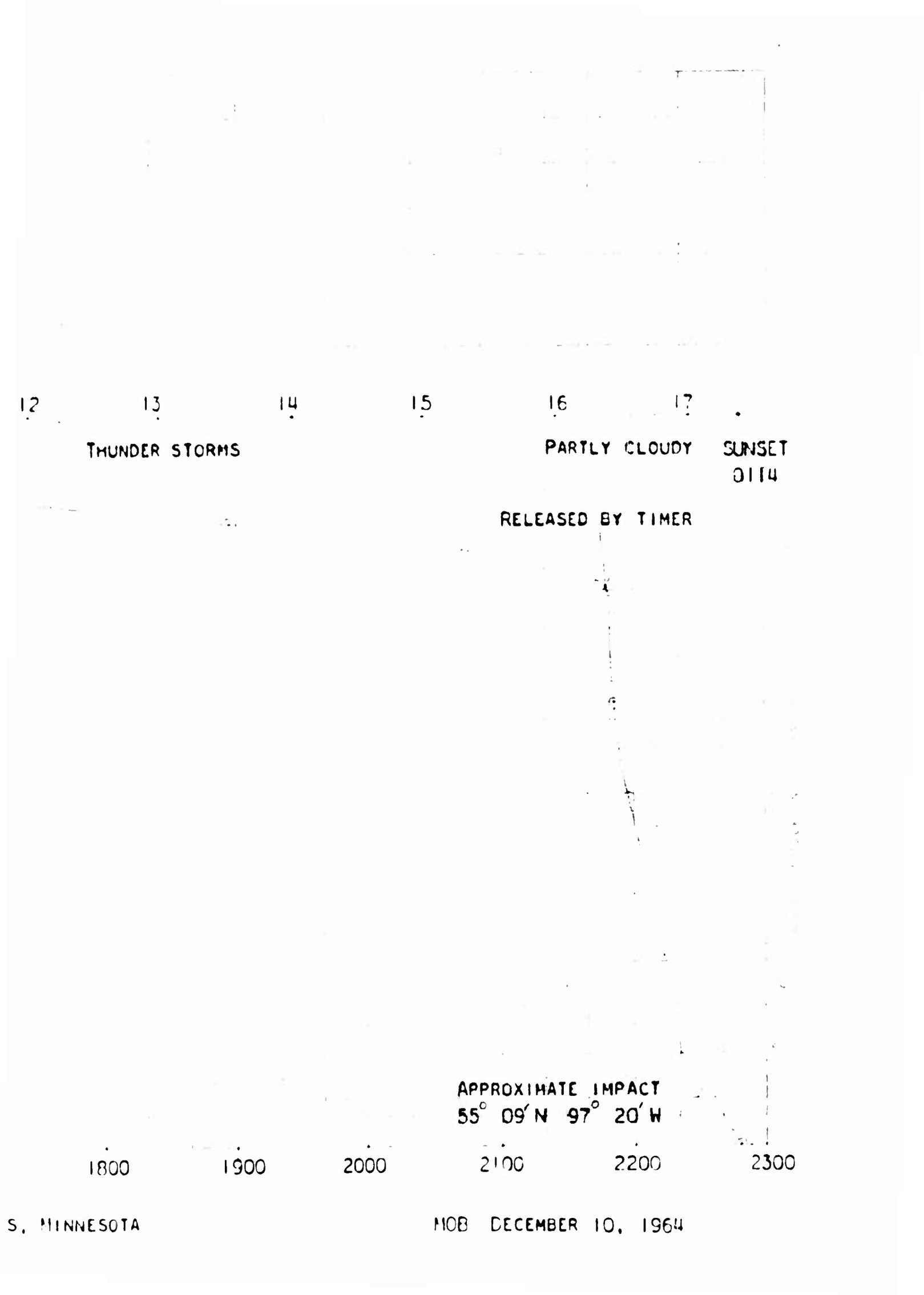



ELAPSED T
3
4
5
6
7
8
OVERCAST
OVERCAST
SUNRISE
THEORETICA
5
DROPPED 13.5
LBS. BALLAST
DROPPED 6.75 LBS.
BALLAST
PED 13.5
BALLAST
FLIGHT NO. 3013 N WA
FLIN FLON, MANITOBA,
OF 5 TO 8 M.P.H. WIT
HUMIDITY WAS HIGH DU
HOURS BEFORE LAUNCH.
LAUNCH.
BS. BALLAST
ALL TIMES
0800
0900
1000
1100
1200
1300
1000
APPLIED SCIENCE DIVIS



FLIGHT NO. 3013 N WAS LAUNCHED FROM BAKERS NARROWS FLIN FLON, MANITOBA, CANADA AT 0525 GMT IN WINDS OF 5 TO 8 N.P.H. WITH GUSTS TO 10 TO 12 M.P.H. HUMIDITY WAS HIGH DUE TO HEAVY DOWN POUR OF RAIN 4 HOURS BEFORE LAUNCH. SKY CONDITIONS WERE CLEAR AT LAUNCH.

B


12
13
14
15
16
17
THUNDER STORMS
PARTLY CLOUDY
SUNSET
0114
RELEASED BY TIMER
APPROXIMATE IMPACT
55° 09′ N 97° 20′ W
1800
1900
2000
2100
2200
2300
S. MINNESOTA
MOB DECEMBER 10, 1964

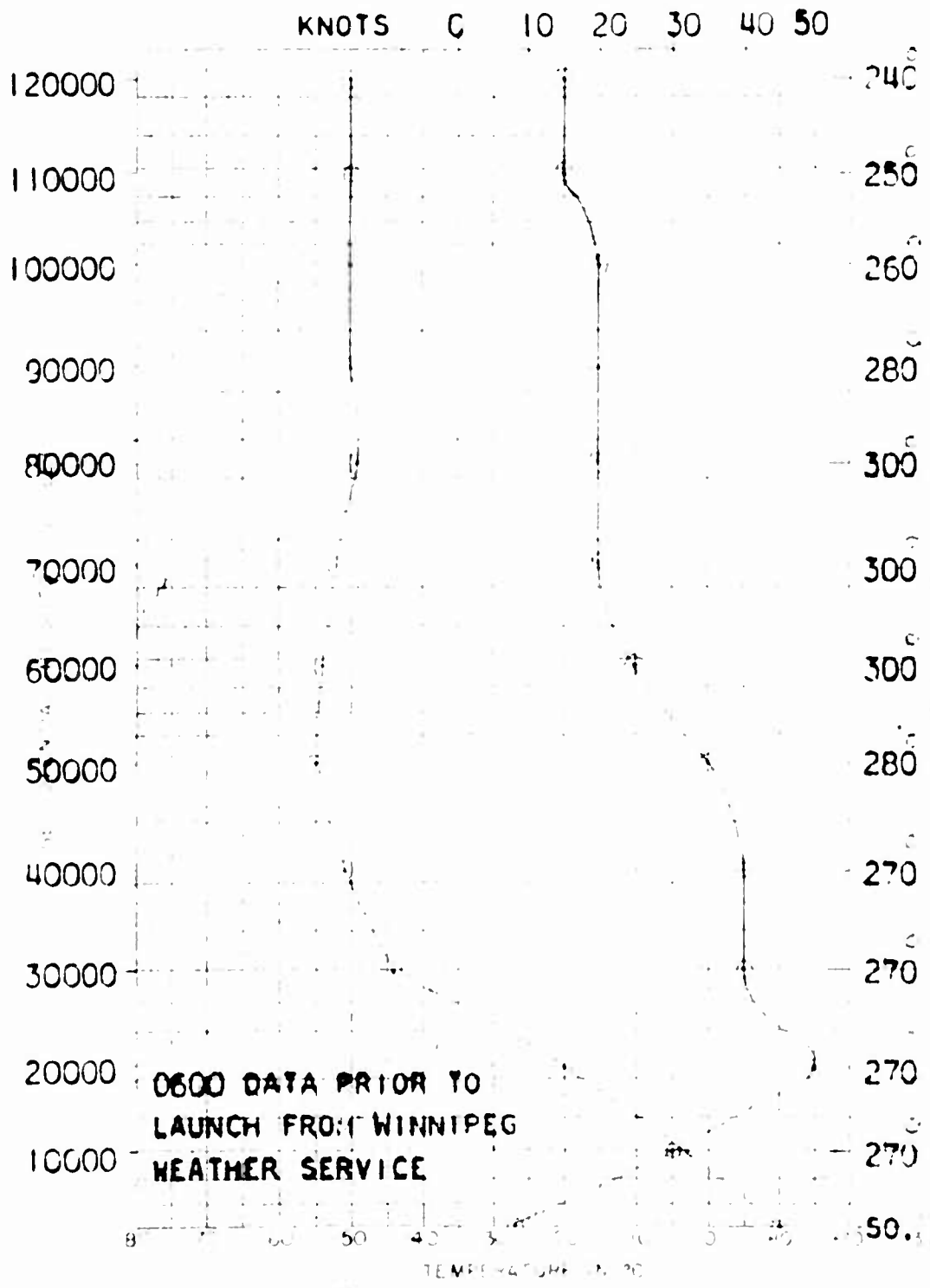
FLIGHT NO. 3015 N DATE 16 SEPT. 1964
FOR 55053
LOAD ON BALLOON 89.25 LBS.
FREE LIFT 23.55 LBS= 12 %

BALLOON TYPE	NUMBER	MATERIAL	WEIGHT
111-1-2	DRS-715 6	.5MIL	107 LBS

ALTITUDE DATA

TEMPERATURE DATA

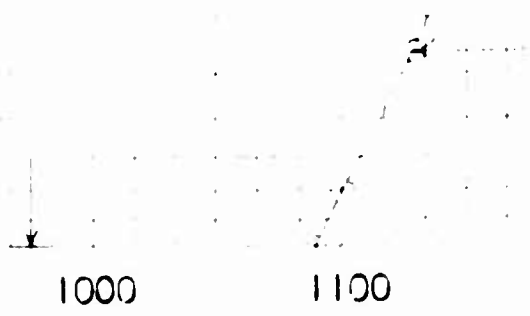
WIND DATA



AVERAGE RATE OF RISE FROM 46000 FT. TO 114500 FT. 868 FPM

AVERAGE RATE OF RISE TO 46000 FT. 867 FPM

0600 DATA PRIOR TO LAUNCH FROM WINNIPEG WEATHER SERVICE



ELAPSED TIME IN

1 2 3 4 5 6 7

1
SUNRISE

80 % CLOUD COVER

CLEAR SKIES

DROPPED 5.5 LBS. BALLAST

LBS.

M

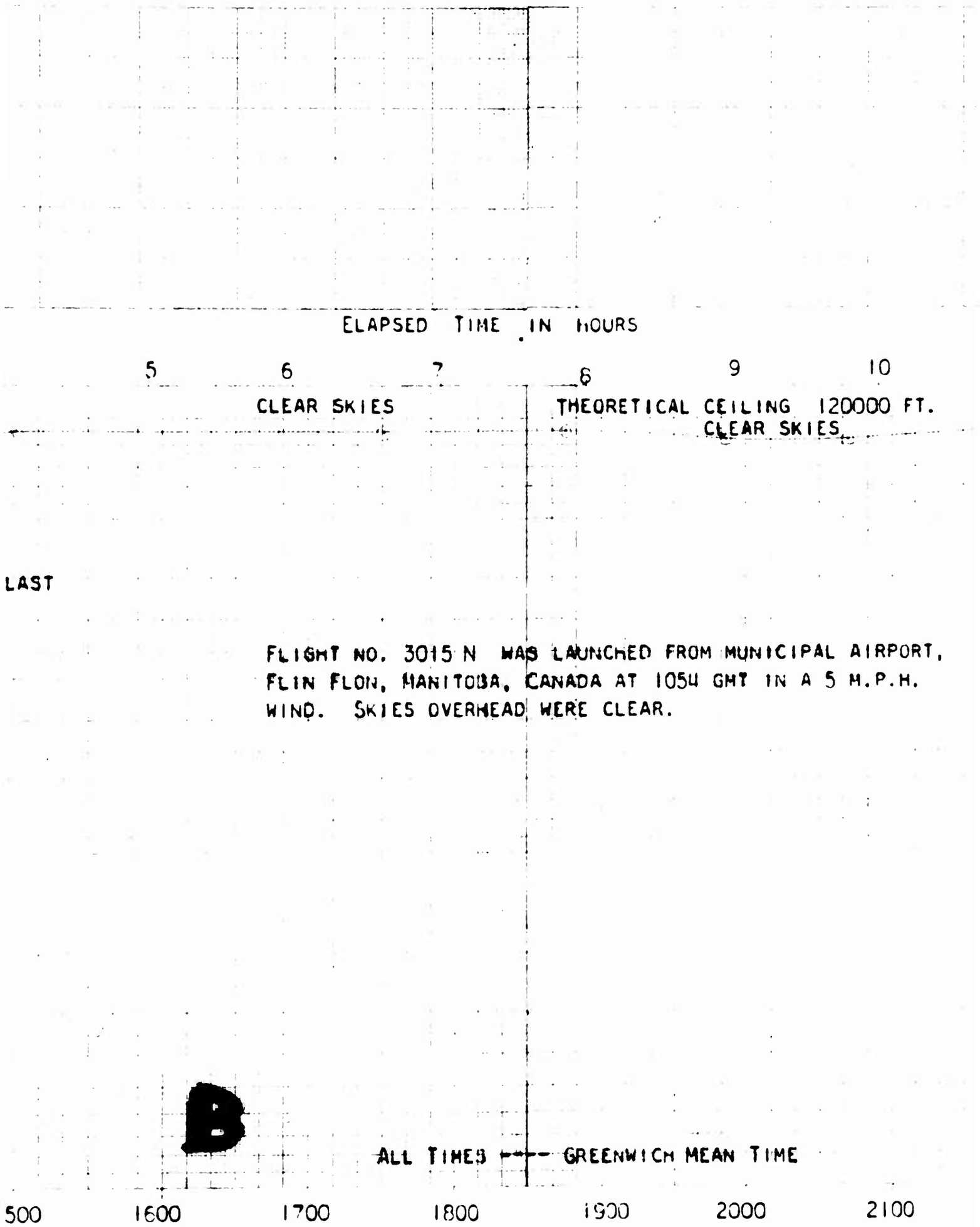
FLIGHT NO. 3015 N WAS
FLIN FLON, MANITOBA, C
WIND. SKIES OVERHEAD

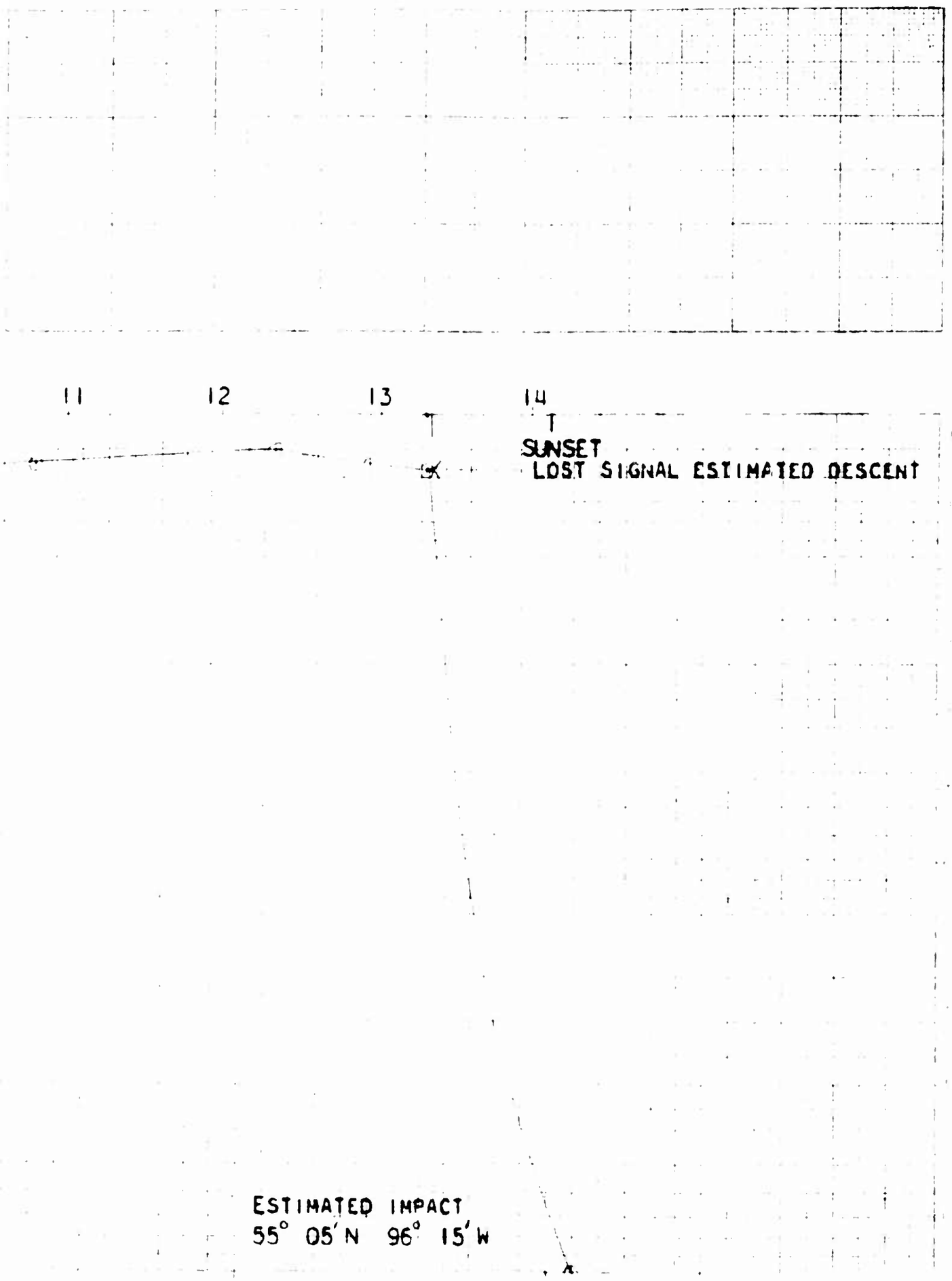
DROPPED 5.5 LBS. BALLAST

ALL TIMES

1200 1300 1400 1500 1600 1700 1800

APPLIED SCIENCE DIVISION LITTON


ELAPSED TIME IN HOURS
5
6
7
8
9
10
CLEAR SKIES
THEORETICAL CEILING 120000 FT.
CLEAR SKIES
LAST
FLIGHT NO. 3015 N WAS LAUNCHED FROM MUNICIPAL AIRPORT, FLIN FLON, MANITOBA, CANADA AT 1054 GMT IN A 5 M.P.H. WIND. SKIES OVERHEAD WERE CLEAR.
B
ALL TIMES ← GREENWICH MEAN TIME
500
1600
1700
1800
1900
2000
2100



ESOTA

MOE DECEMBER 11, 1964

FLIGHT NO. 3016 N DATE 17 SEPT. 1964
FOR 55053
LOAD ON BALLOON 96.5 LBS.
FREE LIFT 25 LBS= 12 %

BALLOON TYPE	NUMBER	MATERIAL	WEIGHT
111 1 2	DRS 715 1	.5 MIL	112 LBS.

ALTITUDE DATA

TEMPERATURE DATA

WIND DATA

KNOTS, 0 10 20 30 40 50

20000 10000 00000 0000 0000 0000 0000 0000 0000 0000

GEOPOTENTIAL HEIGHTS IN FEET

240 250 260 280 300 300 280 270 270 270

0500 DATA PRIOR TO LAUNCH FROM WINNIPEG WEATHER SERVICE

-80 -70 -60 -50 -40 -30 -20 -10 0 +10 +20 +30

TEMPERATURE IN °C

THEORETICAL CEILING 1

AVERAGE RATE OF RISE FROM 46000 FT. TO 80400 FT. 630 F.P.M.

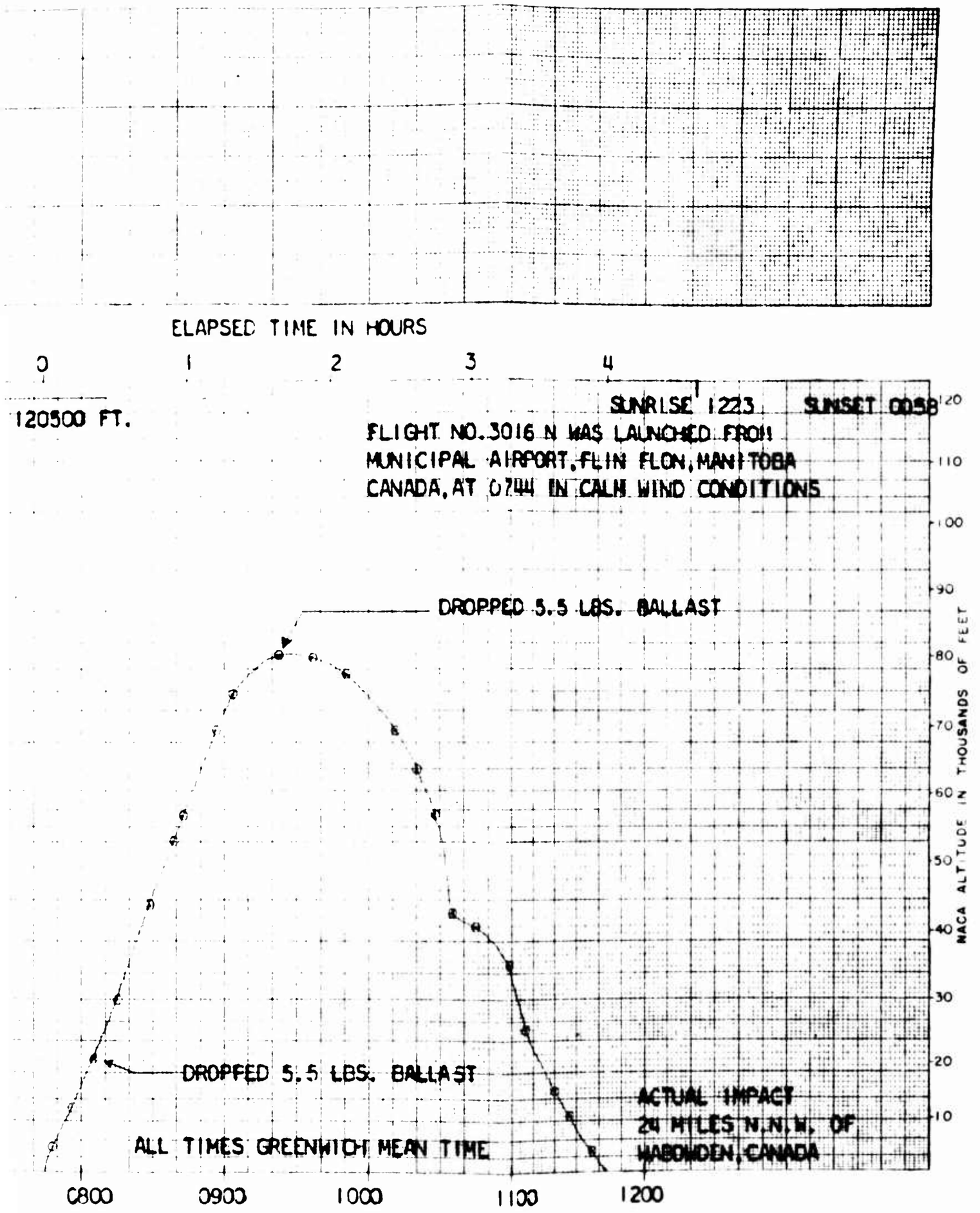
AVERAGE RATE OF RISE TO 46000 FT. 980 F.P.M.

400 500 600 800 1000

0700

APPLIED SCIE

9288 MD-1



IENCE DIVISION L'ITTON SYSTEMS. MINNEAPOLIS, MINNESOTA

A.H.F. 3 NOV. 1964